Report on

Research Project titled

Analysis of Economic Parameters and House Pricing

Submitted

to

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NATIONAL HOUSING BANK

By

Dr. Sahil Garg

Department of Civil Engineering

Indian Institute of Technology Delhi

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Abstract

This research study examines the relationship between economic growth parameters and housing prices in India through a comprehensive analysis of three cities representing different urban tiers. The study addresses the critical need for understanding housing price determinants to inform policy decisions and improve housing affordability in the Indian context.

The research analyzed seven key economic parameters - GDP, GDP growth rate, Sensex, Nifty 50, interest rates, Consumer Price Index, per capita income, and unemployment rate and their relation with housing prices across Bathinda (Tier 3), Ludhiana (Tier 2), and Delhi (Tier 1) over a 24-year period (2001-2024). Primary data was collected through experienced valuers for land prices, and construction costs were calculated using official Plinth Area Rates. For standardisation, analysis was done for 200 square yard plots with a covered area of 2800 square feet.

Linear regression analysis was employed to identify significant relationships between economic parameters and housing prices, with R-squared values used to assess model significance. Data normalisation techniques were applied to enable coefficient comparison and sensitivity analysis across different parameters and cities.

The study reveals that Consumer Price Index (CPI) emerges as the most critical factor influencing housing prices across all city tiers, followed by GDP and per capita income. Per capita income demonstrates greater impact on housing prices than absolute GDP values. Interest rates show the expected negative correlation with housing prices, while GDP growth rate and unemployment rate exhibit statistically insignificant relationships. Regional analysis confirms that higher-tier cities demonstrate greater market volatility and sensitivity to economic parameters, with coefficient values increasing proportionally with urban hierarchy.

The findings provide actionable insights for the National Housing Bank and policymakers, emphasizing inflation control as the primary strategy for housing affordability. The study establishes that tier-specific housing policies are necessary, given the varying sensitivity levels across different urban categories. The research contributes to housing economics literature by quantifying the relative importance of economic parameters in the Indian housing market context and providing empirical evidence for policy formulation.

Keywords: Housing prices, Economic growth, Consumer Price Index, Regional disparities, Linear regression, Housing affordability, Urban hierarchy, Indian real estate market

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Dr. Sahil Garg
Assistant Professor
Department of Civil Engineering
Indian Institute of Technology Delhi

Email: gargsahil@iitd.ac.in

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Chapter 1: Introduction

1.1 Background and Context

India's housing sector represents a cornerstone of economic development, contributing approximately 6-7% to the nation's GDP while serving as a critical indicator of macroeconomic stability. The relationship between economic parameters and housing prices has gained unprecedented importance as India navigates through rapid urbanization, with over 600 million people expected to live in cities by 2031 according to the United Nations World Urbanization Prospects. This massive demographic shift creates immense pressure on housing markets across different urban tiers.

Housing prices across Indian cities have demonstrated remarkable heterogeneity, with metropolitan centers experiencing exponential growth while tier-2 and tier-3 cities follow distinct trajectories. The price appreciation varies dramatically - while cities like Mumbai and Delhi have witnessed 8-12% annual growth rates over the past decade, smaller cities show more moderate but consistent patterns. This disparity reflects varying economic dynamics, infrastructure development, and local market conditions that influence housing affordability and investment patterns.

The National Housing Bank's mandate to regulate and promote housing finance necessitates comprehensive understanding of price formation mechanisms. Economic parameters such as GDP, inflation indices, stock market performance, and interest rates significantly influence housing affordability and market dynamics. The complex interplay between macroeconomic indicators and regional housing markets creates challenges for policymakers attempting to design inclusive housing policies that address diverse urban contexts.

The government's "Housing for All" initiative, launched in 2015, requires evidence-based policy frameworks that account for regional disparities and varying economic sensitivities across urban hierarchies. Recent economic disruptions, including demonetization (2016), GST implementation (2017), and COVID-19 impacts (2020-2021), have highlighted the vulnerability of housing markets to macroeconomic shocks. These events demonstrated that different city tiers respond differently to economic stimuli, with metropolitan markets showing greater volatility compared to smaller urban canters.

Understanding these relationships becomes crucial for effective policy intervention and market regulation. The housing sector's multiplier effect on related industries such as construction, cement, steel, and financial services makes it a critical component of India's economic growth strategy. Furthermore, housing wealth constitutes a significant portion of household assets, making price stability essential for financial security and consumption patterns across different income groups.

1.2 Problem Statement

Despite the housing sector's critical importance, **empirical research quantifying the relative impact of economic parameters on housing prices across different urban tiers remains limited**. Existing studies predominantly focus on metropolitan markets, leaving significant knowledge gaps regarding tier-2 and tier-3 cities that represent the majority of India's urban population. This metropolitan bias in research creates policy blind spots that may inadequately address housing challenges in emerging urban canters.

The fundamental challenge lies in understanding which economic parameters most significantly influence housing prices and how these relationships vary across urban hierarchies. Current literature often examines individual economic parameters in isolation, such as focusing solely on interest rate impacts or GDP correlations, without considering the simultaneous effects of multiple variables. This fragmented approach limits the development of comprehensive policy frameworks that can address the multifaceted nature of housing price determination.

Additionally, **the absence of standardised methodologies** for comparing housing price sensitivity across different city tiers hampers effective policy design. Policymakers require evidence-based insights to prioritise economic indicators for housing market regulation, yet lack systematic frameworks for understanding tier-specific market dynamics. The variation in data availability, market maturity, and institutional frameworks across different urban categories further complicates comparative analysis.

The scarcity of long-term empirical analysis spanning multiple economic cycles reduces the reliability of existing findings. Most studies focus on short-term relationships, typically covering 5-7 years, which may not capture cyclical patterns or structural changes in housing markets. Understanding long-term trends becomes particularly important given the extended nature of housing investment decisions and the cyclical behaviour of real estate markets.

Furthermore, existing research lacks integration of both supply-side factors (construction costs, land prices) and demand-side factors (economic parameters, demographic changes) in a unified analytical framework. This limitation prevents a comprehensive understanding of housing price dynamics and limits the effectiveness of policy interventions that may address only partial aspects of the housing market ecosystem.

1.3 Research Objectives

This study aims to provide **a comprehensive empirical analysis of the impact of economic parameters on housing prices** across different urban tiers in India. The research addresses critical knowledge gaps in housing economics literature while providing actionable insights for policy formulation and market regulation. The study's systematic approach enables comparison of housing market sensitivities across diverse urban contexts, contributing to a more nuanced understanding of regional housing dynamics.

The **primary objective** is to identify and quantify the most critical economic factors influencing housing prices through systematic statistical analysis spanning 24 years (2001-2024). This extensive temporal coverage ensures capture of multiple economic cycles, policy changes, and market transitions that influence housing price behaviour. The analysis incorporates both macroeconomic indicators and market-specific variables to provide a comprehensive understanding of price determination mechanisms.

Specific research objectives include: First, analyzing the relationship between eight key economic parameters (GDP, GDP growth rate, Sensex, Nifty 50, interest rates, Consumer Price Index, per capita income, and unemployment rate) and housing prices across Delhi (Tier 1), Ludhiana (Tier 2), and Bathinda (Tier 3). This multi-parameter approach enables an understanding of the relative importance and interaction effects among different economic variables.

Second, assessing regional disparities in housing price sensitivity to economic parameters, identifying tier-specific market characteristics and volatility patterns. This comparative analysis reveals how market maturity, economic diversity, and institutional frameworks influence housing price behaviour across different urban categories. The findings contribute to understanding why similar economic stimuli produce different housing market responses across various city types.

Third, determining the most influential economic parameters through sensitivity analysis and normalised coefficient comparison, enabling policy prioritisation. This analysis provides

policymakers with evidence-based frameworks for focusing regulatory attention and resource allocation on parameters that most significantly impact housing affordability and market stability.

Fourth, examining 24-year trends to provide insights into long-term market behaviour, cyclical patterns, and structural changes in housing markets. This longitudinal analysis enables the identification of persistent relationships versus temporary correlations, enhancing the reliability of policy recommendations and market forecasting capabilities.

Finally, translating research findings into actionable policy recommendations for the National Housing Bank, government agencies, and other stakeholders involved in housing sector regulation and development. These recommendations are grounded in empirical evidence and tailored to specific urban contexts, enhancing their practical applicability and implementation potential.

1.4 Scope

This research encompasses comprehensive analysis of housing price determinants across three strategically selected cities representing different urban tiers in the Indian context. **The study covers a 24-year period (2001-2024)**, providing extensive temporal coverage that captures multiple economic cycles, policy regimes, and market transitions. This longitudinal approach enables identification of both short-term fluctuations and long-term structural relationships between economic parameters and housing prices.

The geographic scope includes Delhi (Tier 1), Ludhiana (Tier 2), and Bathinda (Tier 3), selected to represent diverse urban characteristics within North India. Delhi represents the metropolitan category with complex economic structures, diversified industries, and mature financial markets. Ludhiana exemplifies industrial tier-2 cities with substantial manufacturing bases and growing service sectors. Bathinda represents smaller urban centers with primarily agricultural hinterlands and emerging commercial activities. This selection provides a representative cross-section of Indian urban hierarchy while maintaining regional coherence.

Primary data collection involves experienced valuers with 25+ years of market expertise, ensuring reliability and local market knowledge. These professionals provide insights into land price trends, market dynamics, and valuation practices that supplement quantitative analysis with qualitative market understanding. Construction costs are derived from official PWD Plinth Area Rates, ensuring standardisation and government validation of cost components.

The analysis focuses on standardised residential housing (a 200 square yard plot with a 2800 square foot covered area) to enable consistent comparison across cities and time periods. This standardisation eliminates variations due to property size, type, or quality differences, allowing focus on economic parameter impacts rather than property-specific characteristics.

1.5 Structure of the Report

This report is systematically organized into **nine** comprehensive sections designed to provide methodical presentation of research methodology, findings, and policy implications. The structure follows established academic conventions while ensuring practical applicability for policy makers and industry stakeholders. Each section builds upon previous analyses while maintaining independent readability for focused consultation.

Chapter 2 presents extensive literature review examining existing research on housing price determinants, economic growth relationships, and regional market studies. The literature review identifies theoretical frameworks, empirical methodologies, and key findings from previous studies while highlighting knowledge gaps that this research addresses. This section establishes theoretical foundations and positions the current study within broader academic discourse on housing economics.

Chapter 3 details comprehensive research methodology, including research design, data collection strategies, statistical analysis techniques, and quality assurance procedures. This section provides sufficient detail to enable replication and validation of research findings. The methodology discussion includes justification for analytical choices, explanation of statistical techniques, and description of data processing procedures that ensure transparency and scientific rigor.

Chapter 4 describes comprehensive dataset compilation, covering economic parameter sources, primary land price data collection, and construction cost analysis methodologies. This section documents data sources, collection procedures, validation methods, and processing techniques used to create the analytical database. Detailed description of data sources enhances credibility and enables future researchers to build upon this foundational work.

Chapter 5 presents detailed analysis, results and discussion, including descriptive statistics, regression analysis outcomes, statistical significance assessments, and sensitivity analysis findings. Results are presented with appropriate statistical measures, and significance tests to enable proper interpretation. Visual representations including graphs, charts, and tables enhance understanding and facilitate communication of key findings. The chapter discusses

regional disparities analysis, comparison with existing literature, and implications for housing policy and market understanding.

Chapter 6 discusses the conclusions, policy recommendations and limitations of the study. The chapter transforms statistical results into meaningful insights for policy makers and market participants. The discussion contextualises findings within broader economic and policy frameworks while acknowledging limitations and alternative interpretations.

The report includes detailed references, appendices containing methodological procedures, data processing scripts, and supporting materials that enhance research transparency and enable replication. These supporting materials demonstrate scientific rigour while providing resources for future researchers and policy analysts working in related areas.

Chapter 2. Literature Review

2.1 Housing Price Determinants: A Global Perspective

International research consistently identifies several factors influencing housing prices: macroeconomic indicators (GDP, inflation, interest rates), financial market performance, demographic trends, and government policies. Globally, the relationship between housing prices and economic stability has been extensively studied. For example, Case & Shiller (2003) demonstrated how house prices in the United States both reflect and shape wider economic cycles. The role of inflation, measured by indices like the Consumer Price Index (CPI), is strongly linked to the cost of housing and material inputs (IMF, 2013). In advanced markets, variables like mortgage rates and stock market indices (e.g., S&P, FTSE) have shown meaningful predictive power for residential price movements. Recent machine learning approaches (He, 2021) provide further evidence that multi-factor models outperform single-variable analyses, underlining the complexity of housing price dynamics worldwide. (IMF, 2013)

2.2 Economic Growth and Real Estate Relationships

Economic growth acts as both a driver and a consequence of real estate market expansion. Rising GDP and per capita income levels generally lead to increased demand for residential property, improved affordability, and renewed investment. Numerous studies demonstrate that housing markets are highly sensitive to changes in income, employment, and investment climate (Mankiw & Weil, 1989). In emerging economies, accelerated urbanization and economic transition amplify housing demand, though supply constraints and speculation can lead to volatility. The relationship between economic growth and housing prices is not always linear: in some cases, real estate bubbles may inflate beyond what fundamentals justify, resulting in market corrections. The robustness of these connections varies by market sophistication, institutional structures, and fiscal policies (Investopedia, 2024).

2.3 Indian Housing Market Studies

Housing price research in India has predominantly focused on metro cities, particularly Mumbai, Delhi, Bengaluru, and Chennai. Earlier studies highlighted the influence of economic growth, policy reforms, and infrastructure investment on real estate dynamics. For instance, KPMG (2012) and NHB Residex suggested strong correlation between GDP growth, urban infrastructure provisioning, and property prices in large urban centers. However, much of the

available literature is limited to shorter time frames or specific local events, not accounting for the broader sweep of India's economic transformation over multiple cycles.

Additionally, rapid urbanisation since 2000 has triggered varied outcomes in tier-2 and tier-3 cities; researchers (Roy, 2018; NHB Residex Reports) note supply-demand mismatches and pockets of speculative price growth. Despite mounting evidence of regional diversity, comprehensive studies comparing multiple economic indicators across different city tiers are scarce. Some analyses (World Bank, 2021) apply hedonic modelling to measure the contribution of location, amenities, and market sentiment, but these often lack depth on economic fundamentals beyond metro-focused datasets.

2.4 Regional Disparities in Housing Markets

A persistent theme in the literature is the uneven distribution of housing price growth across India’s diverse urban landscape. Metropolitan markets typically lead in terms of price appreciation, liquidity, and institutional depth. Contrastingly, tier-2 and tier-3 cities display more stable growth trajectories but face unique challenges: lower market transparency, limited financial products, and thinner investor participation (Invest India 2025).

Studies by the NHB Residex, CRISIL, and the RBI highlight how policy measures, local infrastructure, and demographic trends cause pronounced regional differences. For example, while Delhi and Mumbai may respond rapidly to changes in interest rates or stock market sentiment, cities like Ludhiana and Bathinda are influenced more by local economic activity, migration, and sector-specific booms (e.g., manufacturing, agriculture). The literature also documents episodes of speculative bubbles and corrections, typically concentrated in high-growth nodes rather than throughout the country.

2.5 Research Gap Identification

Despite substantial contributions, several gaps persist in the Indian housing price literature:

- First, there is a lack of long-term, multi-city studies that integrate both macroeconomic variables and supply-side factors such as land and construction costs.
- Second, existing analyses often neglect the unique dynamics of tier-2 and tier-3 cities, limiting the generalizability of findings and the effectiveness of policy recommendations.
- Third, many studies address economic factors in isolation, without accounting for simultaneous influences or interaction effects.

- Fourth, normalization and sensitivity analysis comparing the relative significance of each economic parameter across urban hierarchies is rarely attempted.

This study addresses these gaps by examining the impact of eight major economic variables on housing prices in three city tiers (Delhi, Ludhiana, Bathinda) over a 24-year period, blending primary market data with robust statistical modelling. The research aims to provide actionable insights for both academic advancement and evidence-based policymaking.

Chapter 3. Methodology

3.1 Research Design and Framework

This study employs a **mixed-methods research design** combining quantitative statistical analysis with primary data collection to examine the relationship between economic parameters and housing prices across different urban tiers. The research framework integrates time-series analysis, cross-sectional comparison, and sensitivity analysis to provide comprehensive understanding of housing price determinants in the Indian context.

The research adopts a longitudinal approach spanning 24 years (2001-2024) to capture multiple economic cycles, policy changes, and market transitions. This extended temporal coverage ensures robustness of findings by accounting for both short-term fluctuations and long-term structural relationships. The study design incorporates three distinct analytical phases: descriptive analysis to understand trends and patterns, inferential analysis using linear regression to quantify relationships, and comparative analysis to identify regional disparities across urban tiers.

The **analytical framework** follows a systematic progression from data collection through statistical modelling to policy recommendation development. Economic parameters serve as independent variables while housing prices constitute the dependent variable, with city tier acting as a moderating factor. The research design ensures standardisation across cities through consistent data collection methodologies, comparable property specifications, and uniform analytical techniques.

Quality assurance mechanisms include multiple data source validation, expert consultation for primary data collection, and statistical significance testing for all analytical results. The framework incorporates both supply-side factors (land costs, construction costs) and demand-side factors (economic parameters) to provide a holistic understanding of housing price dynamics. This comprehensive approach enables the identification of critical economic parameters while accounting for regional variations in market behaviour.

The research design follows established econometric principles for housing market analysis while adapting methodologies to suit the Indian urban context. Standardised housing specifications (200 square yards plot, 2800 square feet covered area) ensure consistency across

cities and time periods. The framework enables both individual parameter analysis and multivariate assessment of economic factor interactions.

3.2 Data Collection Strategy

The data collection strategy employs a **dual-source approach** combining secondary data from authoritative government and institutional sources with primary data collection from experienced market professionals. This comprehensive strategy ensures both temporal consistency and local market accuracy while maintaining scientific rigour and reliability standards.

Secondary data collection focuses on national-level economic indicators from established databases, including government statistical offices, central banking institutions, and international organisations. Primary data collection involves consultation with experienced real estate professionals and utilisation of official construction cost schedules. The integration of both data types provides a robust foundation for analytical work while ensuring local market relevance.

Data validation procedures include cross-referencing multiple sources, temporal consistency checks, and expert verification of collected information. All data undergoes systematic cleaning and processing to ensure accuracy and analytical suitability.

The collection strategy prioritizes data reliability over convenience, focusing on authoritative sources even when data access requires additional effort. Temporal alignment ensures all variables correspond to consistent time periods, enabling meaningful comparative analysis. Geographic consistency maintains focus on selected cities while ensuring comparable market conditions and data availability.

Quality control measures include independent verification of critical data points, consultation with multiple experts for primary data validation, and systematic documentation of all data sources and collection procedures. This rigorous approach ensures research findings are based on reliable, accurate, and comprehensive datasets that support meaningful policy recommendations.

3.2.1 Economic Parameter Data Sources

Economic parameter data collection encompasses **eight key indicators** selected for their theoretical relevance and empirical significance in housing market analysis. The selection

criteria prioritize indicators with established relationships to housing markets, consistent data availability across the study period, and policy relevance for housing sector regulation.

Gross Domestic Product (GDP) data is sourced from the Open Government Data (OGD) platform, specifically from the Ministry of Statistics and Programme Implementation. The data includes both nominal and real GDP figures at current and constant prices, enabling analysis of economic growth impacts on housing prices. Annual GDP figures provide a macroeconomic context for housing market performance and enable an assessment of the broader economic influence on property values.

GDP Growth Rate calculations are derived from annual GDP data, representing the percentage change in economic output year-over-year. This indicator captures economic momentum and expansion/contraction phases that influence consumer confidence, investment decisions, and housing demand patterns. Growth rate volatility provides insights into the economic stability impacts on housing market behaviour.

Stock market indices, including Sensex (BSE) and Nifty 50 (NSE), are collected from official exchange sources. These indices serve as proxies for investor sentiment, wealth effects, and overall financial market performance. Stock market data reflects investor confidence levels and liquidity conditions that influence real estate investment decisions. Annual average values are calculated to smooth short-term volatility while capturing longer-term market trends.

Interest rates are sourced from State Bank of India (SBI) home loan rates, representing the cost of housing finance for consumers. Interest rate data includes floating rates for home loans, which directly impact housing affordability and demand patterns. This parameter captures monetary policy impacts on housing markets through financing cost channels.

Consumer Price Index (CPI) data is obtained from World Bank databases, providing standardised inflation measurements comparable across time periods. CPI serves as the primary inflation indicator, capturing cost-of-living changes that influence both housing demand and construction costs. This parameter is critical for understanding purchasing power impacts on housing affordability.

Per capita income information is sourced from World Bank databases, representing average income levels that determine housing purchasing capacity. This indicator captures individual economic capacity for housing consumption and investment, providing a demand-side perspective on housing market dynamics.

Unemployment rate data from World Bank sources represent labour market conditions that influence housing demand through employment security and income stability. Unemployment rates capture economic distress periods and recovery phases that significantly impact housing market performance and consumer behaviour patterns.

3.2.2 Land Price Data Collection

Land price data collection represents the most critical primary data component, requiring extensive consultation with experienced market professionals to ensure accuracy and local market relevance. The methodology prioritises expertise and local knowledge while maintaining consistency and comparability across cities and time periods.

Valuer selection criteria emphasise professional experience, market knowledge, and local expertise. Selected valuers possess a minimum of 25 years of professional experience in their respective markets, ensuring familiarity with long-term price trends and market evolution. Professional credentials include registration with relevant valuation institutions and demonstrated expertise in residential property assessment.

The **consultation process** involves structured interviews with two valuers per city to ensure data reliability and reduce individual bias. Valuers are requested to provide historical land price data for standardised property types in comparable locations within each city. The interview process includes verification of data sources, discussion of market trends, and validation of price evolution patterns.

Geographic standardisation ensures comparable locations across all three cities. Selected areas include Model Town in Ludhiana, Malviya Nagar in Bathinda, and Lajpat Nagar in Delhi, all representing residential areas with similar amenity access. Each location features comparable infrastructure, including railway stations, bus stands, markets, schools, and hospitals within reasonable proximity.

Property specifications are standardised across all cities and time periods. Land parcels of approximately 200 square yards are consistently analysed, representing typical residential plot sizes. This standardisation eliminates size-related price variations and enables focus on economic parameter impacts rather than property-specific characteristics.

Validation procedures include cross-referencing valuer inputs, checking consistency with known market events, and comparing trends across cities for logical consistency. Extreme

values are investigated and verified before inclusion in the analytical dataset. Documentation includes detailed records of all valuer consultations, data sources, and validation procedures.

3.2.3 Construction Cost Data

Construction cost analysis utilizes **official government sources** to ensure accuracy, consistency, and legal compliance with established construction standards. The methodology relies on Plinth Area Rates (PAR) published by respective State Public Works Departments, providing standardized construction cost estimates across different time periods.

3.4 House Price Calculation Model

The house price calculation model employs a **standardized cost-summation approach** that combines land acquisition costs with construction expenses to derive total housing prices across all three cities and time periods. This methodology ensures consistency and comparability while reflecting actual market pricing mechanisms that consider both land value and construction investments.

The fundamental pricing equation follows the formula:

$$\textbf{House Price} = \textbf{Land Cost} + \textbf{Construction Cost}$$

Where:

- **Land Cost** = Land price per square yard × Plot size (200 square yards)
- **Construction Cost** = [(GF PAR × GF Area) + (FF PAR × FF Area)] × Service Factor

Standardised property specifications ensure analytical consistency across all cities and time periods. The model assumes a uniform residential unit comprising a **200 square yard plot** (equivalent to 1,800 square feet) with **2,800 square feet total covered area** distributed across the ground floor (1,400 square feet) and the first floor (1,400 square feet) construction.

Land cost calculation multiplies the prevailing market price per square yard by the standardised plot size of 200 square yards. Land prices are sourced from experienced valuers with 25+ years of local market expertise, ensuring accuracy and reliability of historical price data across the study period.

Construction cost methodology integrates official Plinth Area Rates (PAR) from respective State Public Works Departments with a standardised service cost factor. Basic construction costs are calculated separately for ground-floor and first-floor components, reflecting different structural requirements and complexity levels.

Service cost integration applies a uniform **30% markup** to basic PAR rates, representing additional expenses for electrical installations, plumbing systems, finishing work, and other essential services. This standardized approach ensures comprehensive cost coverage while maintaining analytical consistency across different cities and time periods.

3.5 Regional Selection Criteria

Regional selection criteria ensure representative coverage of different urban tiers while maintaining analytical consistency and data availability. The selection process balances geographic diversity, economic representativeness, and practical feasibility considerations to provide meaningful insights into tier-specific housing market dynamics.

Delhi selection represents **Tier 1 metropolitan markets** characterized by complex economic structures, diversified industrial bases, mature financial markets, and extensive infrastructure networks. Delhi serves as the national capital with concentrated government employment, multinational corporate presence, and sophisticated real estate markets. The selection captures metropolitan market dynamics including high liquidity, investor participation, and sensitivity to macroeconomic changes.

Ludhiana selection represents **Tier 2 industrial cities** with substantial manufacturing bases, growing service sectors, and emerging real estate markets. Ludhiana exemplifies industrial centers that combine traditional manufacturing strength with modern service sector development. The city provides insights into markets with balanced economic structures, moderate price levels, and growing investor interest.

Bathinda selection represents **Tier 3 regional centres** with primarily agricultural hinterlands, emerging commercial activities, and developing real estate markets. Bathinda captures smaller urban markets with strong rural connections, local economic dependencies, and price levels accessible to broader population segments. The selection enables analysis of markets with different economic drivers and development patterns.

Geographic coherence maintains focus on North Indian cities within similar cultural, economic, and policy contexts while representing different urban development levels. This regional consistency eliminates cultural and policy variations that might confound economic parameter analysis while enabling meaningful tier-based comparisons.

Infrastructure comparability ensures selected cities provide similar basic amenities and development standards within their respective tiers. Each city offers comparable transportation

access, educational facilities, healthcare services, and commercial infrastructure appropriate to their urban category. This standardisation focuses analysis on economic factors rather than infrastructure disparities.

Data availability considerations influence selection by prioritising cities with accessible historical data, willing expert participation, and reliable information sources. Selected cities provide sufficient data depth and expert knowledge to support comprehensive analysis across the 24-year study period. Market transparency and professional valuer availability ensure data reliability and validation possibilities.

3.6 Statistical Analysis Techniques

The statistical analysis framework employs **multiple complementary techniques** to examine relationships between economic parameters and housing prices while ensuring robust, reliable, and interpretable results. The methodology integrates descriptive statistics, inferential analysis, and comparative assessment to provide a comprehensive understanding of housing market dynamics.

3.6.1 ***Linear Regression Analysis***

Linear regression serves as the primary analytical tool for quantifying relationships between individual economic parameters and housing prices across different urban tiers (Johnson and Miller 2011). The methodology employs simple linear regression models of the form:

$$\text{Housing Price} = \beta_0 + \beta_1(\text{Economic Parameter}) + \varepsilon$$

Where β_0 represents the intercept, β_1 indicates the slope coefficient measuring parameter impact, and ε captures the error term.

Model specification ensures consistency across all parameter-city combinations while maintaining analytical rigor. Each economic parameter is analyzed independently against housing prices for each city, generating 24 individual regression models (8 parameters × 3 cities) that enable systematic comparison of parameter effectiveness and regional variations.

Coefficient interpretation provides direct measurement of economic parameter impacts on housing prices. Positive coefficients indicate that parameter increases correspond to housing price increases, while negative coefficients suggest inverse relationships. Coefficient magnitudes quantify the expected housing price change per unit increase in the economic parameter.

Statistical significance testing employs standard t-tests and p-values to assess the reliability of observed relationships. Parameters with p-values below 0.05 are considered statistically significant, indicating confidence that observed relationships are not due to random variation.

3.6.2 R-squared Significance Testing

R-squared analysis measures the explanatory power of each economic parameter in accounting for housing price variations (Johnson and Miller 2011). R^2 values range from 0 to 1, with higher values indicating stronger relationships between economic parameters and housing prices.

Interpretation thresholds establish systematic criteria for assessing relationship strength:

- **$R^2 > 0.80$**: Exceptionally strong relationship
- **R^2 0.60-0.80**: Strong relationship
- **R^2 0.40-0.60**: Moderate relationship
- **R^2 0.20-0.40**: Weak relationship
- **$R^2 < 0.20$**: Very weak or negligible relationship

Model validation employs adjusted R-squared values to account for the number of variables and sample size, ensuring that high R^2 values reflect genuine relationships rather than statistical artifacts. F-statistic tests overall model significance, confirming that regression models provide meaningful improvement over simple mean predictions.

Comparative analysis enables ranking of economic parameters based on their explanatory power across different cities. Parameters with consistently high R^2 values across multiple cities demonstrate robust predictive capacity, while those with variable performance may indicate context-specific or non-linear relationships.

3.6.3 Data Normalisation Methods

Data normalization enables direct comparison of coefficient impacts across economic parameters with different measurement scales and magnitudes (Johnson and Miller 2011). The methodology employs z-score standardization to transform all variables to comparable scales while preserving relative relationships.

Z-score formula : $Z = (X - \mu) / \sigma$

Where X represents the original value, μ is the mean, and σ is the standard deviation. This transformation creates standardised variables with zero mean and unit variance, enabling direct coefficient comparison across different parameters.

Normalised coefficient interpretation measures the standard deviation change in housing prices corresponding to one standard deviation change in each economic parameter. This standardisation enables ranking of parameter importance regardless of original measurement units or scales.

Sensitivity analysis employs normalised coefficients to assess relative parameter impacts and identify the most critical drivers of housing price variations. Parameters with larger normalised coefficients demonstrate greater influence on housing market dynamics, informing policy prioritisation and intervention strategies.

Cross-parameter comparison becomes meaningful through normalisation, enabling systematic assessment of whether GDP, CPI, interest rates, or other parameters exert stronger influences on housing prices. This comparative capability represents a significant methodological advantage for policy analysis and academic research.

Chapter 4. Data Collection and Sources

4.1 Economic Parameters Dataset

The economic parameters dataset encompasses **comprehensive macroeconomic indicators** spanning 24 years (2001-2024) from authoritative national and international sources. The dataset construction prioritises temporal consistency, data reliability, and analytical compatibility while ensuring coverage of key economic variables that theoretically influence housing market dynamics. Each parameter is selected based on established economic theory, empirical evidence from housing market research, and practical relevance for policy formulation.

Data collection follows systematic procedures ensuring temporal alignment across all variables, with annual data points providing sufficient granularity for trend analysis while smoothing short-term volatility that might obscure underlying relationships. **Quality assurance protocols** include cross-validation with multiple sources, consistency checks across time periods, and expert verification of data accuracy and completeness.

The dataset integrates both real and nominal values where appropriate, enabling analysis of inflation-adjusted relationships alongside absolute value correlations.

4.2 GDP and GDP Growth Rate

Gross Domestic Product data is sourced from the Open Government Data (OGD) platform maintained by the Ministry of Statistics and Programme Implementation, Government of India. The dataset includes both nominal GDP (at current market prices) and real GDP (at constant 2011-12 prices) to enable analysis of both absolute economic size and inflation-adjusted growth patterns. Annual GDP figures are compiled from national accounts statistics following international standards and methodological consistency.

GDP data collection encompasses the complete study period from 2001 to 2024, providing comprehensive coverage of multiple economic cycles, including periods of rapid growth (2003-2008), global financial crisis impacts (2008-2010), economic recovery phases (2010-2016), and recent economic transitions (2017-2024). The data captures structural changes in the Indian economy, including service sector expansion, manufacturing growth, and agricultural productivity improvements.

An example of GDP calculation is shown in Figure 1.

• GDP: Open Government Data (OGD)

Item	Value (Rs. In Crore) - 2011-12 - Q1	Value (Rs. In Crore) - 2011-12 - Q2	Value (Rs. In Crore) - 2011-12 - Q3	Value (Rs. In Crore) - 2011-12 - Q4
1. Agriculture	0	323221.72	270231.38	505545.34
2. Mining & quarrying	64670.25	55462.63	65815.18	75087.31
3. Manufacturing	350857.05	329936.53	334726.67	394465.31
4. Electricity	0	0	44661.97	46631.13
5. Construction	182218.75	189095.78	197079.15	208940.87
6. Trade	0	0	0	330069.72
7. Financial	0	395102	407657.04	343064.87
8. Public administration	0	225668.84	263656.97	245398.66
9. GVA at Basic Price	1916470.3	1900302.91	2091166.28	2199006.5
10. GDP	2043496.29	2029469.17	2244852.23	2418511.13

GDP of year 2011-12 = 2043496.29+2029469.17+2244852.23+2418511.13 = 8736328.82

Figure1: Collection of Economic Parameter(GDP)

GDP Growth Rate calculations are derived from year-over-year percentage changes in real GDP, representing the pace of economic expansion or contraction. Growth rate calculations follow standard methodologies:

$$Growth\ Rate = [(GDP\_t - GDP\_\{t-1\})/GDP\_\{t-1\}] \times 100$$

where t represents the current year and t-1 represents the previous year. An example calculation of GDP growth is shown in Figure 2. This methodology ensures consistency with official government statistics and international reporting standards.

- GDP Growth Rate: $\left(\frac{GDP_{i+1} - GDP_i}{GDP_i}\right) \times 100$
- GDP of 20011=87.3lakh cr
- GDP of 2012=97.5lakh cr
- Growth rate $= (\frac{97.5-87.3}{87.3})*100=11.68\%$

Figure 2: Collection of Economic Parameter (GDP Growth rate)

The GDP growth rate dataset reveals significant variations ranging from negative growth during crisis periods to double-digit growth during boom periods. These fluctuations provide valuable analytical variation for assessing housing market sensitivity to economic momentum

changes. The data captures both gradual growth transitions and sharp economic adjustments that test housing market resilience and responsiveness.

Data validation procedures include cross-referencing with Reserve Bank of India statistics, World Bank databases, and International Monetary Fund country reports. Consistency checks ensure alignment with official government publications and international statistical standards. Any discrepancies are investigated and resolved through consultation with authoritative sources and economic experts.

4.3 Stock Market Indices (Sensex, Nifty 50)

Sensex (BSE Sensitive Index) data is collected from the Bombay Stock Exchange, representing India's oldest and most established stock market benchmark. The Sensex comprises 30 financially sound companies across diverse sectors, serving as a comprehensive barometer of Indian stock market performance and investor sentiment. Annual average values are calculated from daily closing prices to provide stable indicators that smooth short-term market volatility while capturing longer-term trends.

The Sensex dataset spans the complete 24-year study period, capturing major market events including the dot-com boom and bust (2000-2003), global financial crisis (2008-2009), European debt crisis impacts (2011-2012), and recent market developments (2020-2024). This comprehensive coverage enables analysis of housing market relationships during various market conditions and economic cycles.

A sample data point is shown in Figure 3.

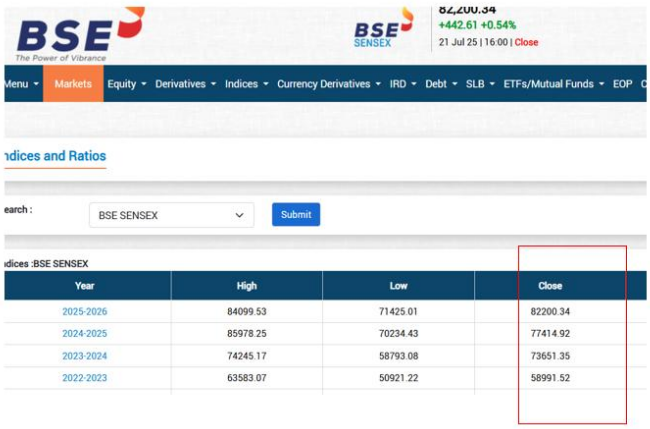


Figure 3: Collection of Economic Parameter (Nifty 50)

Nifty 50 Index data is sourced from the National Stock Exchange of India, representing the weighted average of 50 Indian company stocks across 13 sectors. The Nifty 50 provides

broader market representation compared to Sensex while maintaining focus on large-cap companies with strong financial performance. The index serves as a benchmark for institutional investors and provides insights into overall market capitalization trends. A sample data point is shown in Figure 4.

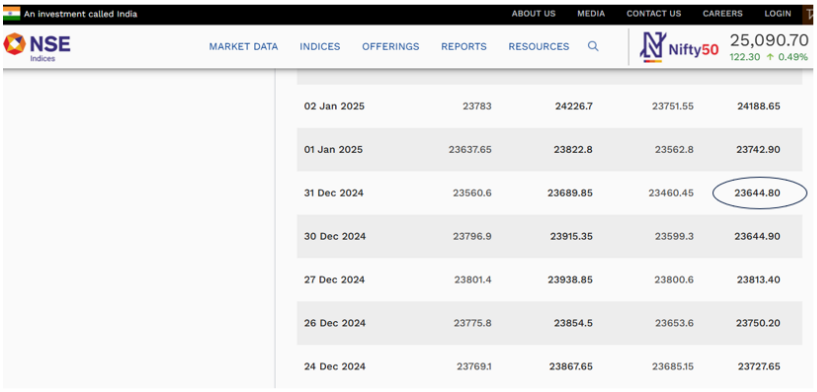


Figure 4: Collection of Economic Parameter (Nifty)

Both indices serve as **proxy variables for wealth effects**, investor confidence, and financial market liquidity conditions that influence real estate investment decisions. Stock market performance affects housing demand through multiple channels including wealth effects (rising stock values increase purchasing power), confidence effects (market performance influences investment sentiment), and liquidity effects (market conditions affect capital availability for real estate investment).

Data collection methodology involves downloading historical data from official exchange sources, calculating annual averages from daily closing values, and adjusting for any index reconstitution or methodological changes. The data undergoes consistency checks to ensure accuracy and completeness across the study period. Market data is cross validated with financial news reports and market analysis to verify major events and movements.

4.4 Interest Rates

Interest rate data is primarily sourced from State Bank of India (SBI) home loan interest rates, representing the cost of housing finance for Indian consumers. SBI is selected as the data source due to its position as India's largest public sector bank, extensive geographic coverage, and representative pricing policies that influence broader market rates. The focus on home loan rates ensures direct relevance to housing market dynamics rather than general monetary policy indicators.

The dataset includes **floating interest rates for home loans**, which represent the most common financing option for housing purchases in India. Floating rates capture both monetary policy changes and market-specific adjustments in housing finance costs. The data covers various loan categories, including standard home loans, affordable housing loans, and construction financing options that serve different market segments.

Interest rate collection methodology involves systematic compilation of advertised rates, effective rates, and promotional rates offered by SBI during different time periods. Annual average rates are calculated to smooth temporary promotional offers while capturing underlying rate trends. The methodology accounts for changes in lending policies, risk assessment procedures, and regulatory requirements that influence interest rate determination. A sample of the data collection is shown in Figure 5.

Interest rate impacts on housing markets operate through **affordability channels** (higher rates increase monthly payments and reduce purchasing power) and **investment channels** (rate changes affect the relative attractiveness of real estate versus other investment options). The relationship between interest rates and housing prices typically exhibits negative correlation, with higher rates dampening demand and potentially reducing price growth.

Interest Rates of Home Loans wef 01/01/2009 TO 09/05/2019						
			SBAR	upto 5 years	5 yrs to 15 yrs	
01-01-2009 - PBBU/HL/IR/ 42 DT 29th December 2008	28/6/2009	upto Rs 30 Lacs	12.25%	9.75%	10.00%	11.25%
		Rs 30 lac to 75 lacs		10.25%	10.50%	12.25%
		Above 75 lacs		10.25%	10.50%	12.25%
Cir.No. PBBU/HL/AX/46 DT.31.01.2009 SBI Happy-Home Loan Offer & SBI Lifestyle Loan w.e.f 2nd February 2009 to 30th April, 2009 Cir.No. PBBU/HL/PM/02 DT.27.04.2009 - Extension upto 30th September 2009						
29-06-2009		upto Rs 30 Lacs	11.75%	9.25%	9.50%	10.75%
		Rs 30 lac to 75 lacs		9.75%	10.00%	11.75%
		Above 75 lacs		9.75%	10.00%	11.75%
02-02-2009 - PBBU/HL/AX/46 DT. 31.01.2009 SBI Happy Home Loan Offer	30-06-2009	SBI Happy Home Loan Offer	8% fixed for one year upto 30th April 2010 & extened upto 30th sep 2009	Fixed reset period 5 years		
01-07-2009 - PBBU/HL/AX/04 DT. 23.06.2009 - Easy Home Loan	30-09-2009	SBI Easy Home Loan - Upto Rs.30 Lacs	Int. Rate First year 8% p.a. & Fixed Int Rate for next two years 9% p.a.	4th year onwards 2% below SBAR **Fixed rate loan 1% below SBAR**		
01-07-2009 - Cir.No. PBBU/HL/PM/05 -	30-09-2009	SBI Advantage	Int. Rate First year 8% p.a. & Fixed Int Rate for next two years 9.5% p.a.	4th year onwards 1.5% below SBAR **Fixed rate loan 0.5% below SBAR**		

Figure 5: Collection of Economic Parameter (Interest rate)

Data validation procedures include cross-referencing with Reserve Bank of India policy rates, other major bank offerings, and housing finance company rates. Consistency checks ensure temporal alignment with monetary policy changes and market conditions. Any significant rate changes are verified against policy announcements and market developments to ensure accuracy and contextual understanding.

4.5 Consumer Price Index

Consumer Price Index (CPI) data is sourced from World Bank databases, providing standardized inflation measurements that enable international comparisons and temporal consistency. The CPI represents changes in the cost of living for urban consumers, capturing price movements across a comprehensive basket of goods and services including housing, food, transportation, healthcare, education, and recreation. A sample of the data collection is shown in Figure 6.

Figure 6: Collection of Economic Parameter(CPI)

The World Bank CPI data for India follows international methodological standards while incorporating country-specific consumption patterns and price collection procedures. **Base year adjustments** are handled systematically to maintain temporal consistency across the study period. The data captures both headline inflation (including volatile components) and core inflation trends that reflect underlying price pressures.

CPI serves as the **primary inflation indicator** in this study due to its comprehensive coverage of consumer expenses and direct relationship to purchasing power and cost of living. Housing costs constitute a significant component of CPI calculations, creating both direct relationships (housing costs affect CPI) and indirect relationships (CPI affects housing demand through purchasing power changes) with housing market dynamics.

Inflation impacts on housing markets operate through multiple channels including cost-push effects (inflation increases construction and land costs), demand-pull effects (inflation reduces real purchasing power and housing affordability), and expectation effects (inflation expectations influence investment decisions and market sentiment). The relationship between

inflation and housing prices can be complex, with moderate inflation sometimes supporting housing demand while high inflation may constrain affordability.

Data collection procedures ensure consistency with official Indian statistical sources while benefiting from World Bank standardization and quality assurance processes. Cross-validation includes comparison with Reserve Bank of India inflation data, Central Statistics Office consumer price statistics, and international inflation databases to ensure accuracy and reliability.

4.6 Per Capita Income

Per capita income data is obtained from World Bank databases, representing average income levels that determine individual and household capacity for housing consumption and investment. The data is presented in Indian Rupees (INR) to maintain consistency with housing price data and enable direct affordability calculations. Per capita income serves as a key demand-side indicator capturing the economic capacity for housing market participation.

World Bank per capita income calculations follow **standardized methodologies** that enable international comparisons while accounting for country-specific economic structures and statistical systems. The data incorporates both formal and informal sector income estimates, providing comprehensive representation of Indian income levels. Purchasing power parity adjustments are available but nominal INR values are prioritized for direct comparison with housing costs.

Income distribution effects are captured through per capita averages while acknowledging that housing markets are typically influenced by income levels of potential buyers rather than population averages. The relationship between per capita income and housing prices generally exhibits positive correlation, with higher income levels supporting greater housing demand and higher price levels.

Temporal analysis of per capita income reveals significant growth trends reflecting India's economic development, structural transformation, and productivity improvements. The data captures both gradual income growth and periods of rapid advancement that influence housing market dynamics. Income growth patterns provide insights into changing affordability conditions and market expansion potential across different time periods.

A sample of data collection is shown in Figure 7.

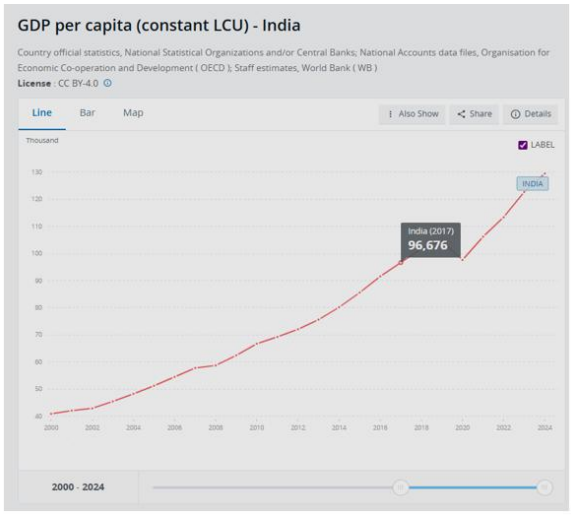


Figure 7: Collection of economic parameters (Per capita income)

Data validation includes **cross-referencing with National Sample Survey Office (NSSO) household income surveys**, Central Statistics Office income statistics, and Reserve Bank of India economic surveys. Consistency checks ensure alignment with broader economic growth patterns and employment trends that influence income levels.

4.7 Unemployment Rate

Unemployment rate data is sourced from World Bank databases, representing the percentage of the labor force that is willing and able to work but unable to find employment. A sample of data collection is shown in Figure 8. The data follows International Labour Organization (ILO) standards for unemployment measurement, ensuring consistency with global practices and enabling comparative analysis. Unemployment rates serve as indicators of economic distress and labor market conditions that influence housing demand through employment security and income stability channels.

Methodological considerations include definitions of unemployment, labor force participation, and employment categories that vary across time periods and statistical systems. The World Bank data incorporates adjustments for informal sector employment, seasonal variations, and definitional changes to maintain temporal consistency. Both urban and overall

unemployment rates are considered, with emphasis on urban rates given the focus on urban housing markets.

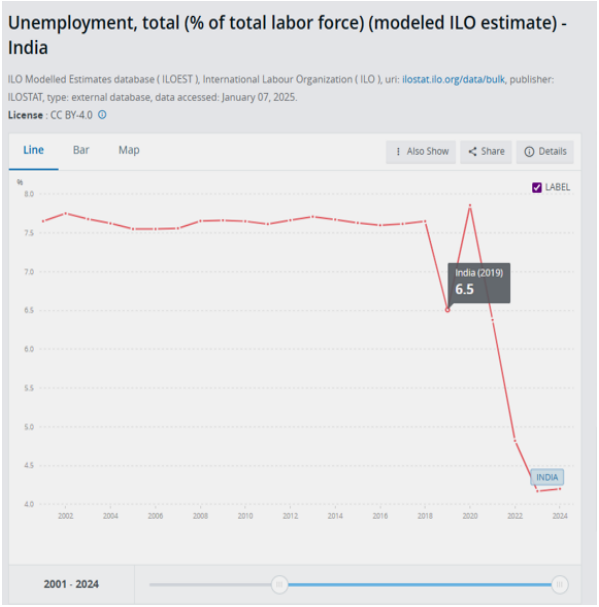


Figure 8: Collection of Economic Parameter (Unemployment rate)

Unemployment impacts on housing markets typically operate through confidence effects (higher unemployment reduces consumer confidence and major purchase decisions) and affordability effects (unemployment reduces household income and purchasing capacity). The relationship between unemployment and housing prices generally exhibits negative correlation, with higher unemployment dampening housing demand and price growth.

Labor market dynamics captured in unemployment data include structural changes in employment patterns, economic cycle effects, and policy interventions that influence job creation and labor market participation. The Indian context includes considerations of informal employment, agricultural sector dependence, and urbanization effects on employment patterns.

Data collection procedures include validation against **Ministry of Labour and Employment statistics**, National Sample Survey Office employment surveys, and Centre for Monitoring Indian Economy (CMIE) labor market data. Consistency checks ensure alignment with broader economic conditions and policy changes that influence employment levels.

4.8 Primary Data Collection

Primary data collection represents a **critical component** of this research, providing location-specific information on land prices and construction costs that cannot be obtained from secondary sources. The primary data collection strategy emphasises expert consultation, local

market knowledge, and standardised methodologies to ensure reliability and comparability across cities and time periods.

4.8.1 Land Price Data

Based on the discussion in section 3.2.2, the average land rate obtained from 2 valuers for a particular year for a particular area in a city is tabulated in Table 1.

Table 1: Collection of land prices (INR per Sq yd)

Year	Land Price (Bathinda)	Land Price (Ludhiana)	Land Price (Delhi)
2001	4000	8000	50000
2002	4200	8500	75000
2003	4500	9250	85000
2004	5000	10000	100000
2005	6000	15000	130000
2006	6100	20000	165000
2007	7000	30000	195000
2008	9000	40000	225000
2009	10000	50000	230000
2010	12000	60000	235000
2011	14000	62500	238000
2012	16000	65000	240000
2013	18000	70000	242000
2014	20000	75000	246000
2015	21000	77500	250000
2016	23000	80000	270000
2017	24500	85000	290000
2018	26000	90000	300000
2019	27500	95000	325000
2020	30000	100000	350000
2021	31500	100000	450000
2022	33000	110000	520000
2023	34000	125000	625000

2024	35000	135000	675000

4.8.2 Construction Cost Analysis

Construction cost analysis utilizes official Plinth Area Rates (PAR) published by respective State Public Works Departments to ensure standardization, accuracy, and legal compliance. The PAR used in the study are given in Table 2.

Table 2: Collection of PAR (Plinth Area Rate)

Year	**PAR per Sqft for Bathinda and Ludhiana (PWD of Punjab)**		**PAR per Sqm for Delhi (PAR published by CPWD)**	
	GF	FF	GF	FF
1997	285	295	4074	3870
2004	400	400	5872	5579
2007	530	530	9000	8550
2012	728	700	16000	15200
2020	1239	966	19700	18715

Punjab PWD Plinth Area Rates provide construction cost data for Bathinda and Ludhiana, representing standardized costs per square foot for residential construction. These rates are updated periodically to reflect changes in material costs (cement, steel, bricks), labor rates, and construction technologies. The rates include basic construction components but exclude specialized installations and service connections.

Delhi PWD Plinth Area Rates serve as the cost basis for Delhi analysis, accounting for metropolitan location premiums, stricter building codes, and higher material and labor costs. Delhi rates typically exceed Punjab rates due to urban cost premiums, regulatory complexity, and market conditions specific to the national capital region.

Service cost calculations incorporate standardized additions to basic PAR rates to account for electrical, plumbing, finishing, and other service installations. A **30% service cost factor** is applied uniformly across all calculations, representing industry-standard additional costs

beyond basic structural construction. This methodology ensures comprehensive cost coverage while maintaining analytical consistency.

Construction type differentiation distinguishes between Ground Floor and First Floor construction costs, reflecting structural differences, accessibility requirements, and construction complexity variations. Ground floor rates include foundation work, basic structural elements, and ground-level installations. First floor rates account for additional structural support, access construction, and elevation-specific requirements.

Example Calculation of House Price

- A plot size of 200 Sqyd (1800 Sqft) with 1400 sqft covered area on GF and FF is considered
- House Price = Land cost+ Construction cost
- For Bathinda in 2020 = (30000 x 200) + (1239 x 1400+ 966 x 1400) x1.3

  =10013100
- For Ludhiana in 2020= (100000 x 200)+(1239 x 1400+966x1400)x1.3

  =24013100
- For Delhi in 2020 =(350000 x 200)+(19700x 130+ 18715x130)x1.3

  = 76495346

Chapter 5. Results and Discussion

5.1 Descriptive Statistics

5.1.1 Housing Price Trends (2001-2024)

The **24-year housing price analysis** reveals distinct evolutionary patterns across the three urban tiers, with each city demonstrating unique growth trajectories that reflect their economic structures, market sophistication, and development pressures. Housing prices are calculated using the standardized methodology, applied consistently across all cities and time periods to enable meaningful comparative analysis.

Bathinda (Tier 3) exhibits the most **stable price evolution,** with land costs growing from ₹4,000 per square yard in 2001 to ₹35,000 per square yard in 2024, representing a **775% increase** over the study period. The growth pattern demonstrates remarkable consistency with a compound annual growth rate (CAGR) of approximately **9.5%**, reflecting stable local market conditions, limited speculative activity, and gradual urbanization pressures. The city's housing market shows minimal volatility, with price increases following predictable patterns aligned with local economic development and infrastructure improvements.

Ludhiana (Tier 2) demonstrates **more dynamic price movements** with land costs rising from ₹8,000 per square yard in 2001 to ₹135,000 per square yard in 2024, representing a **1,588% increase**. The CAGR of approximately **12.8%** indicates stronger growth momentum compared to Bathinda, reflecting the city's industrial base, growing service sector, and emerging real estate sophistication. Notable acceleration occurs during 2005-2010, with prices increasing from ₹15,000 to ₹60,000 per square yard, followed by more moderate but sustained growth in subsequent years.

Delhi (Tier 1) showcases the most **dramatic price evolution,** with land costs increasing from ₹50,000 per square yard in 2001 to ₹675,000 per square yard in 2024, representing a **1,250% increase**. Despite high absolute growth, the CAGR of **12.1%** is slightly lower than Ludhiana's, but demonstrates much higher price volatility. The market experienced significant stagnation during 2009-2015, followed by rapid acceleration from 2016 onwards, reflecting complex interactions between policy changes, economic cycles, and speculative activities.

Construction cost evolution based on Plinth Area Rate (PAR) data shows steady increases across all regions. Punjab PAR rates increased from ₹285-295 per square foot in 1997 to ₹1,239

(Ground Floor) and ₹966 (First Floor) per square foot in 2020, representing approximately **335-434% increases**. Delhi PAR rates increased more dramatically from ₹4,074 (GF) and ₹3,870 (FF) per square foot in 1997 to ₹19,700 (GF) and ₹18,715 (FF) per square foot in 2020, representing approximately **384-483% increases**.

Regional price disparities have evolved significantly, with the Delhi-Bathinda price ratio increasing from **12.5:1 in 2001 to 19.3:1 in 2024**, indicating growing regional inequality in housing affordability. The Ludhiana-Bathinda ratio increased from **2:1 to 3.9:1**, suggesting that tier-2 cities experience faster price appreciation relative to tier-3 centers, though the gap remains more moderate than metropolitan disparities.

5.1.2 Economic Parameter Evolution

Economic parameter evolution over the 24-year study period captures India's transformation from an emerging economy to a major global economic power, with profound implications for housing market dynamics. The comprehensive dataset reveals cyclical patterns, structural changes, and policy impacts that influence housing price behavior across different urban hierarchies.

GDP growth trajectory demonstrates India's sustained economic expansion, with the economy growing from approximately ₹47 trillion in 2001 to over ₹280 trillion in 2024 (at current prices), representing a **495% increase** over the study period. The data captures multiple economic cycles including rapid growth periods (2003-2008, 2014-2018), adjustment phases during global financial crises (2008-2010, 2020-2021), and structural transformation periods reflecting policy reforms, technological advancement, and demographic dividends.

Stock market performance exhibits remarkable growth with substantial volatility. The Sensex increased from approximately **3,000 points in 2001 to over 80,000 points in 2024**, representing a **2,567% increase**. Similarly, the Nifty 50 grew from around **1,000 points to over 24,000 points** during the same period. Both indices experienced multiple boom-bust cycles, major corrections during crisis periods, and strong recoveries during expansion phases, providing substantial variation for analyzing wealth effects on housing markets.

Interest rate environment demonstrates generally declining trends over the study period, with SBI home loan rates falling from approximately **12-13% in 2001 to 6.5-8.5% in 2024**. The declining interest rate environment reflects monetary policy evolution, financial sector development, improved macroeconomic stability, and central bank policy frameworks. The

data captures multiple cycles of rate increases during inflationary pressures and monetary tightening phases, followed by accommodative periods supporting economic growth.

Consumer Price Index progression reveals varying inflation patterns with periods of high inflation (2008-2012, 2021-2022) followed by more moderate price growth phases (2013-2020). CPI increased from the base index of **100 in 2012 to approximately 180 by 2024**, representing moderate but persistent inflationary pressures. The data captures major inflationary episodes including commodity price spikes, policy-induced inflation, supply chain disruptions, and subsequent stabilization efforts.

Per capita income growth demonstrates consistent improvement from approximately **₹22,000 in 2001 to ₹200,000 in 2024**, representing a **809% increase** over the study period. This growth trajectory reflects India's economic development, productivity improvements, structural transformation toward higher value-added activities, and expanding service sector contributions. Income growth patterns show acceleration during economic boom periods and moderation during adjustment phases.

Unemployment rate fluctuations reveal cyclical patterns ranging from **2.8% to 8.5%** over the study period. Unemployment rates generally increase during economic downturns and decrease during expansion phases, with structural trends reflecting changes in labor market dynamics, skill requirements, economic sector composition, and policy interventions affecting employment generation.

5.1.3 Regional Comparison Overview

Regional comparison analysis reveals systematic differences in housing market behavior across the three urban tiers, reflecting variations in economic structure, market maturity, development patterns, and integration with national economic conditions. These differences provide crucial insights for understanding tier-specific market dynamics and policy requirements.

Price level analysis demonstrates substantial and growing disparities across urban tiers. By 2024, Delhi land prices (₹675,000 per square yard) were **19.3 times higher** than Bathinda prices (₹35,000 per square yard) and **5 times higher** than Ludhiana prices (₹135,000 per square yard). These disparities reflect different economic conditions, development pressures, infrastructure quality, employment opportunities, and investment attractiveness across urban hierarchies.

Growth rate patterns reveal interesting variations across cities and time periods. While Delhi maintains the highest absolute price levels, percentage growth rates show different dynamics. Ludhiana demonstrates the **highest CAGR (12.8%)**, followed by Delhi (12.1%) and Bathinda (9.5%), suggesting that tier-2 cities may be experiencing the most dynamic market conditions, balancing growth potential with relative affordability.

Volatility characteristics demonstrate that higher-tier cities experience greater price fluctuations while lower-tier cities maintain more stable growth trajectories. Delhi shows the highest standard deviation in annual price changes, followed by Ludhiana and Bathinda respectively. This pattern reflects different levels of market sophistication, speculative activity, policy sensitivity, and economic integration.

Market cycle behavior shows varying responses to economic conditions. Delhi demonstrates pronounced volatility with periods of rapid growth followed by stagnation, reflecting high sensitivity to macroeconomic conditions, policy changes, and investor sentiment. Ludhiana exhibits moderate cyclical behavior with sustained growth interrupted by brief adjustment periods. Bathinda maintains relatively stable growth with minimal cyclical variation, suggesting greater insulation from national economic fluctuations.

Cost structure differences reveal varying land-construction cost relationships across cities. Delhi housing costs are dominated by land prices (approximately **80-85%**), reflecting intense urban development pressures and land scarcity. Ludhiana shows more balanced relationships (approximately **70-75% land costs**), while Bathinda exhibits higher construction cost proportions (approximately **55-60% land costs**), indicating different market dynamics and development patterns.

5.2 Regression Analysis Results – Individual Parameter Analysis

5.2.1 Variation of House Price with GDP

GDP Relationship Analysis reveals **exceptionally strong positive correlations** across all three cities, demonstrating that absolute economic size serves as a fundamental driver of housing price appreciation. Linear regression analysis confirms consistent and statistically significant relationships between GDP levels and housing prices across all urban tiers.

Bathinda GDP correlation demonstrates **exceptional statistical significance** with **R^2 = 0.986**, indicating that GDP variations explain **98.6%** of housing price fluctuations, as shown in Figure 9. The regression coefficient of **39,520** shows that for every **₹1 lakh crore increase in GDP**, Bathinda housing prices increase by approximately **₹39,520**. Despite the smallest

absolute impact, the relationship demonstrates remarkable consistency across the entire GDP spectrum, validating GDP as a reliable predictor even in tier-3 markets.

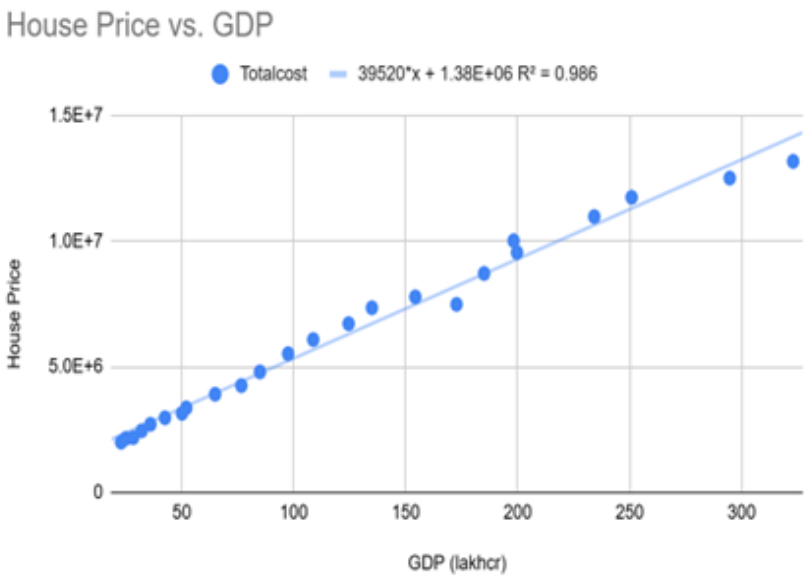


Figure 9: Variation of House Price with GDP (Bathinda)

Ludhiana GDP relationship shows **robust correlation** with **$R^2 = 0.944$**, explaining **94.4%** of housing price variations as shown in Figure 10. The regression coefficient of **99,248** indicates that each **₹1 lakh crore GDP increase** corresponds to approximately **₹99,248 increase** in Ludhiana housing prices. The relationship maintains excellent linearity throughout the economic growth period, demonstrating consistent responsiveness to macroeconomic expansion.

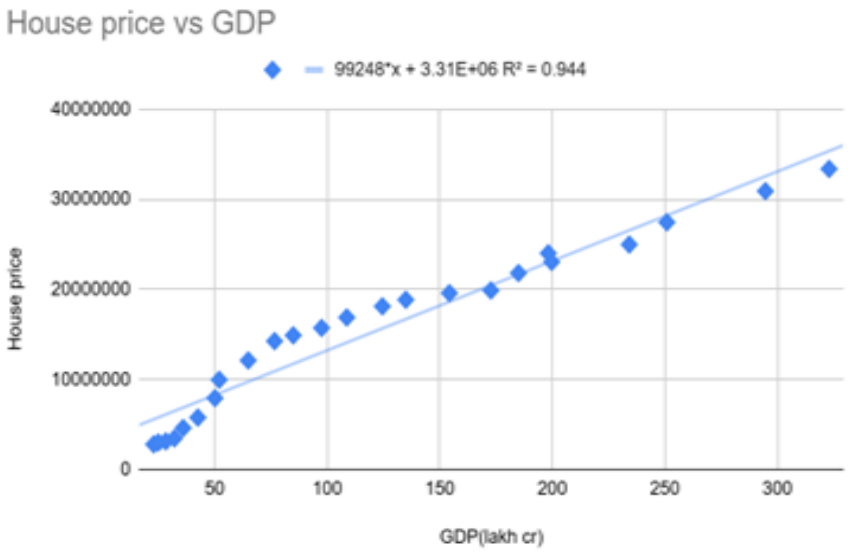


Figure 10: Variation of House Price with GDP (Ludhiana)

Delhi GDP correlation maintains **very strong statistical significance** with **R^2 = 0.924**, representing **92.4%** explanatory power as shown in Figure 11. The regression coefficient of **362,748** shows that each **₹1 lakh crore GDP increase** results in approximately **₹362,748 housing price increase**. Despite having the lowest R^2 among the three cities for this parameter, the relationship demonstrates strong consistency and the highest absolute sensitivity to macroeconomic conditions.

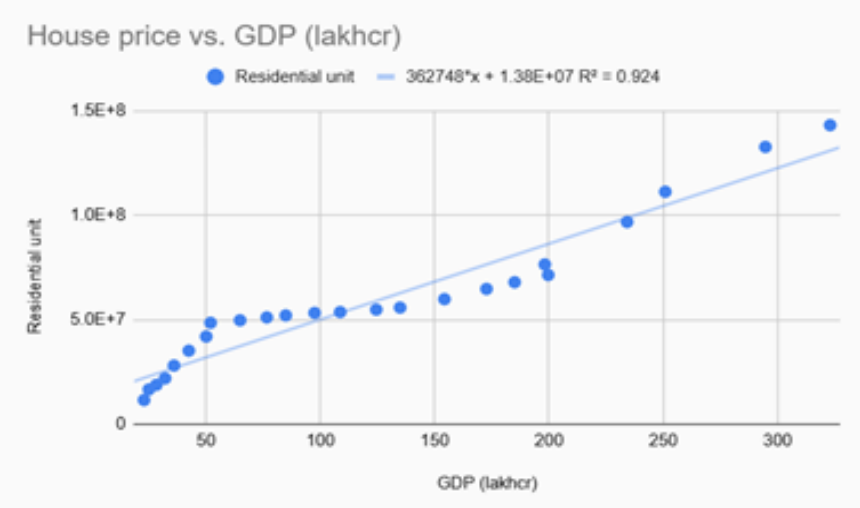


Figure 11: Variation of House Price with GDP (Delhi)

5.2.2 Variation of House Price with GDP Growth

GDP Growth Rate Analysis reveals **extremely weak correlations** across all cities, confirming the absence of meaningful linear relationships between economic growth momentum and housing prices as seen from Figures 12 to 14. The analysis validates the research finding that "No clear trend with GDP growth is observed," with R^2 values ranging from **0.001 to 0.013**, indicating that growth rates explain less than **1.3%** of housing price variations. This finding suggests that housing markets respond more to economic stability and absolute wealth levels rather than short-term growth momentum.

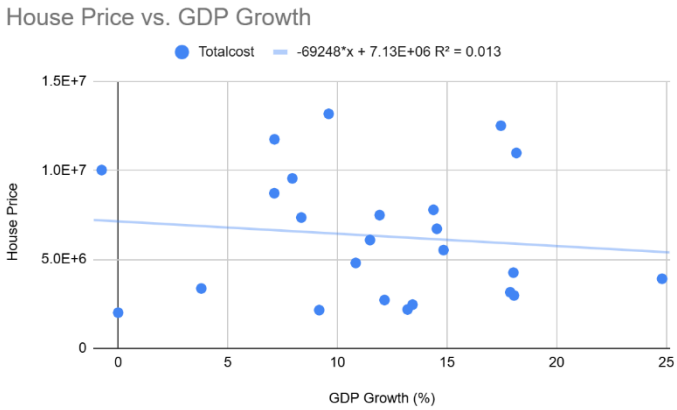


Figure 12: Variation of House Price with GDP growth rate (Bathinda)

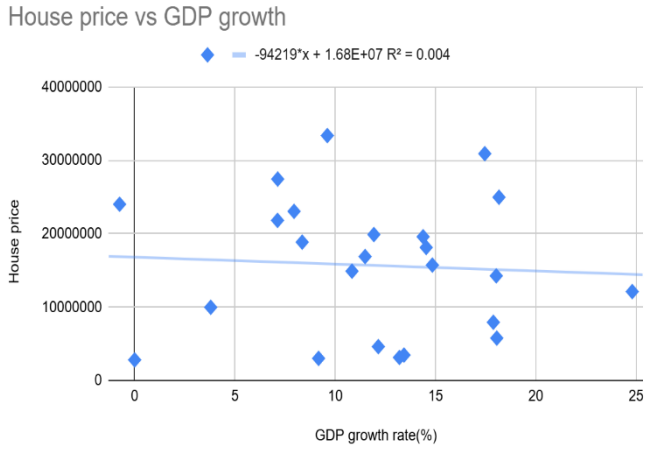


Figure 13: Variation of House Price with GDP growth rate (Ludhiana)

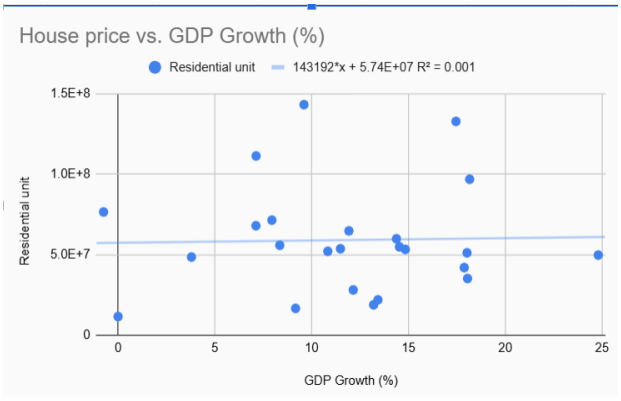


Figure 14: Variation of House Price with GDP growth rate (Delhi)

5.2.3 Variation of House Proce with Sensex

Stock Market Index Relationships demonstrate **strong positive correlations** across all cities as seen in Figures 15 to 17, with varying degrees of sensitivity based on urban tier sophistication and market integration.

Sensex analysis shows robust relationships with R^2 values of **0.966 (Delhi), 0.907 (Ludhiana), and 0.949 (Bathinda)**. The coefficients indicate that a **1,000-point increase in Sensex** is associated with housing price increases of **₹15.13 lakh (Delhi), ₹3.97 lakh (Ludhiana), and ₹1.58 lakh (Bathinda)**. These relationships confirm wealth effects and investor sentiment impacts across all urban tiers.

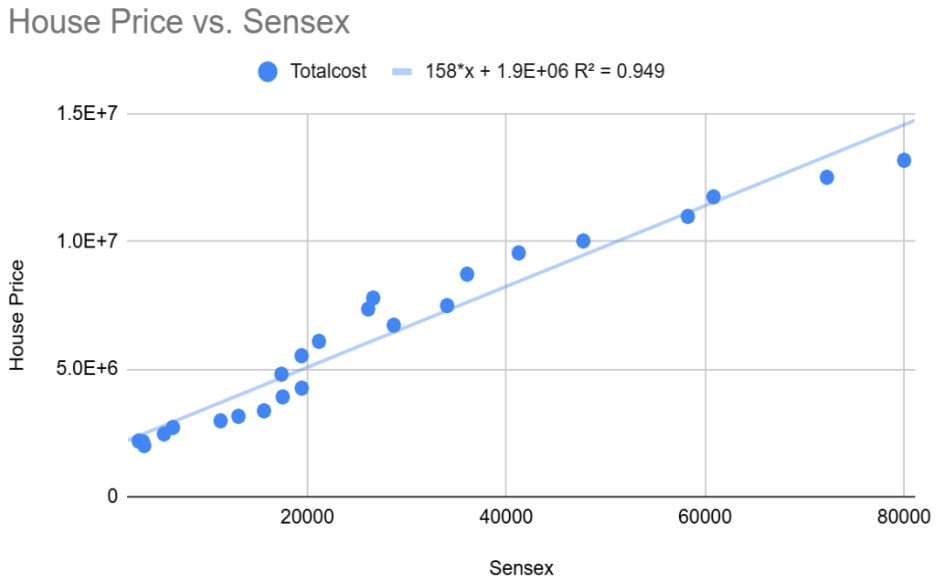


Figure15: Variation of House price with Sensex growth (Bathinda)

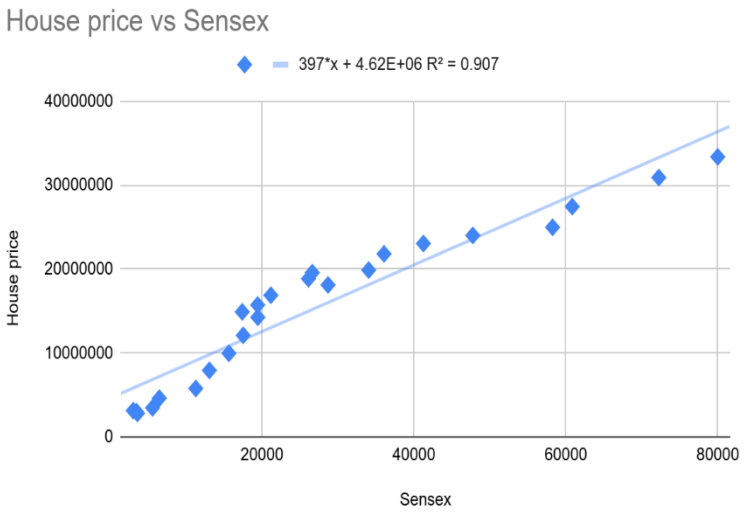
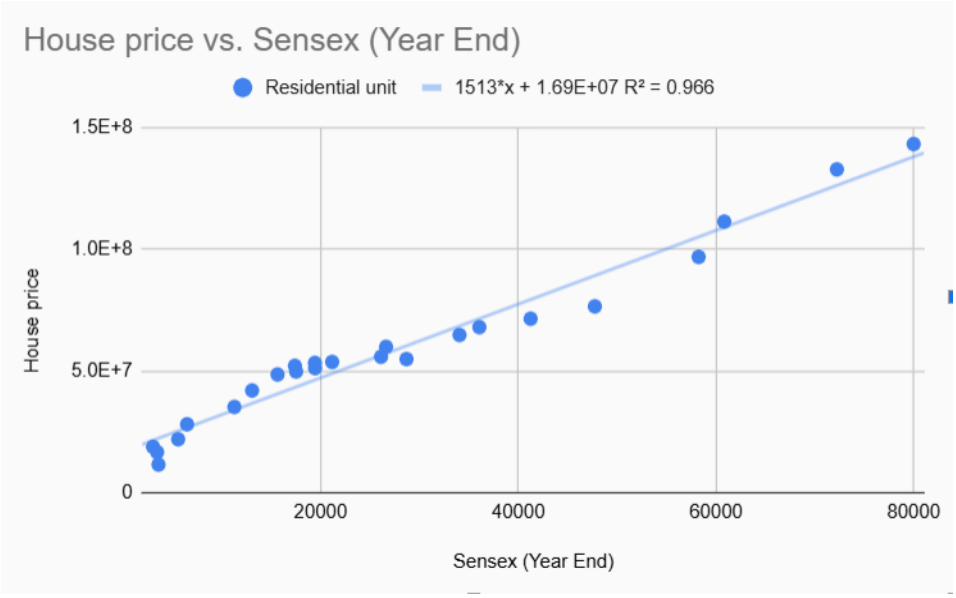


Figure16: Variation of House price with Sensex growth (Ludhiana)

Figure17: Variation of House price with Sensex growth (Delhi)



5.2.4 Variation of House Price with Nifty 50

Nifty 50 relationships demonstrate similar patterns with R^2 values of **0.96 (Delhi), 0.89 (Ludhiana), and 0.938 (Bathinda)** as seen from Figures 18 to 20. The coefficients show that **1,000-point Nifty increases** correspond to housing price increases of **₹51.8 lakh (Delhi), ₹13.5 lakh (Ludhiana), and ₹5.4 lakh (Bathinda)**. The consistent positive relationships across all tiers validate stock market performance as a reliable housing market indicator.

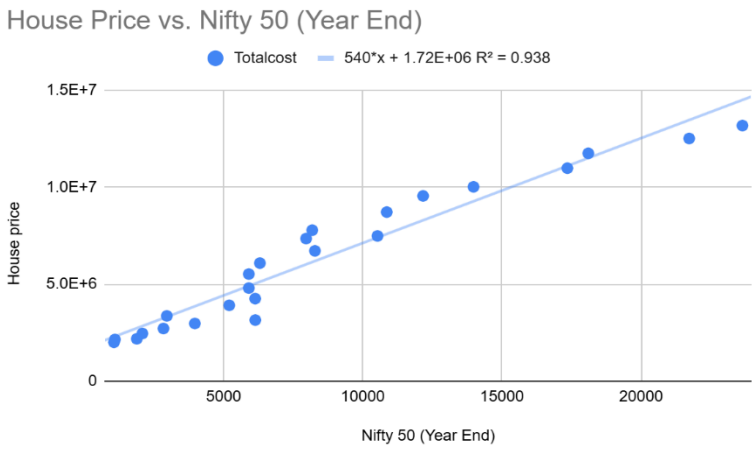


Figure 18: Variation of House price with NIFTY 50 (Bathinda)

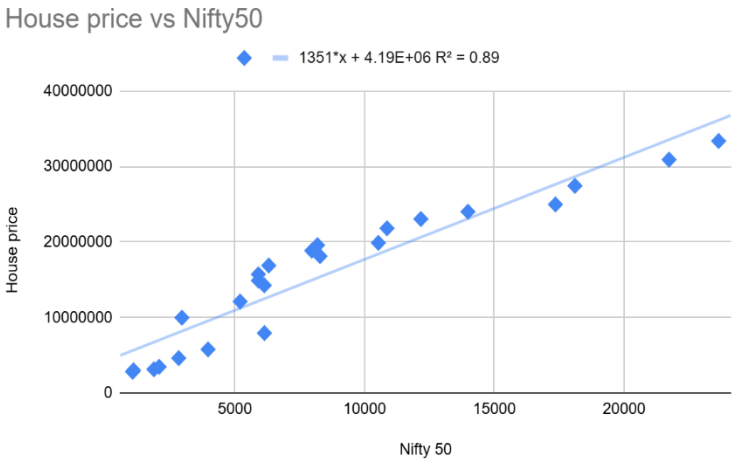
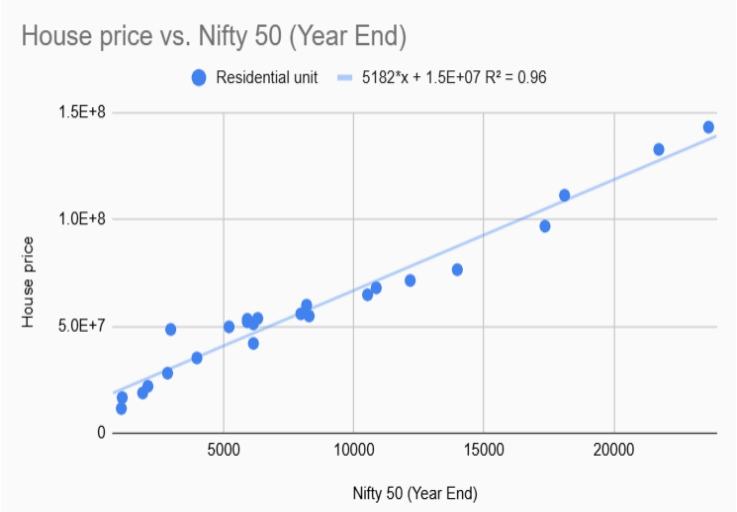


Figure 19:Variation of House price with NIFTY 50 (Ludhiana)

Figure 20: Variation of House prices with NIFTY 50 (Delhi)



5.2.5 Variation of House Price with Interest Rate

Interest Rate Analysis reveals **negative correlations** as theoretically expected, but with varying statistical significance across urban tiers as shown in Figures 21 to 23. The relationships demonstrate moderate explanatory power with R^2 values of **0.42 (Delhi), 0.399 (Ludhiana), and 0.466 (Bathinda)**. The coefficients indicate that **1% interest rate increases** are associated with housing price decreases of **₹179 lakh (Delhi), ₹47.2 lakh (Ludhiana), and ₹19.9 lakh (Bathinda)**. The moderate R^2 values suggest that while interest rates influence housing prices, other factors dominate the relationship.

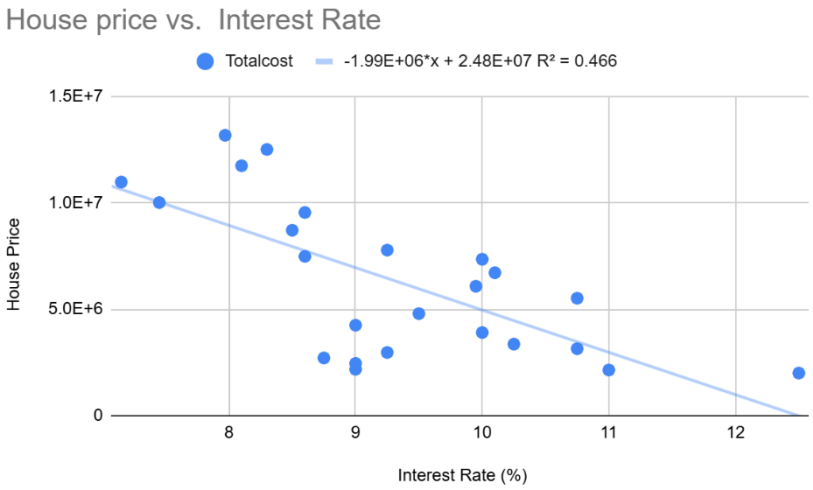


Figure 21: Variation of House price with Interest rate (Bathinda)

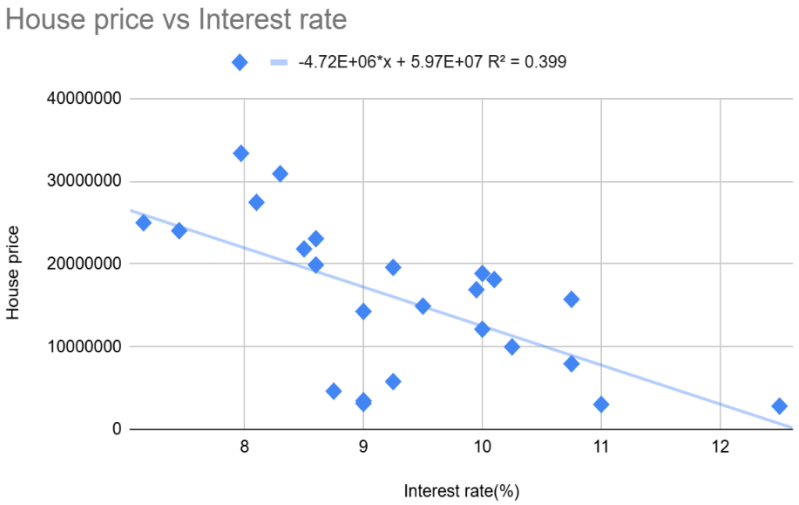


Figure 21: Variation of House price with Interest rate (Ludhiana)

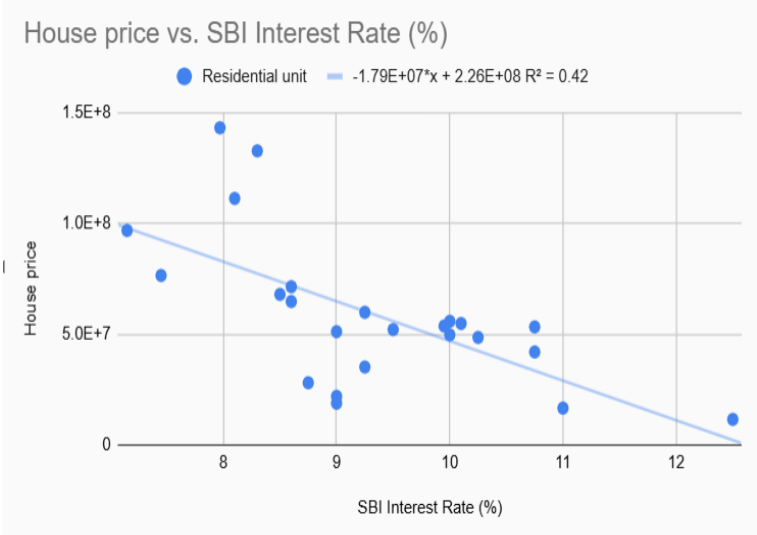


Figure 23: Variation of House price with Interest rate (Delhi)

5.2.6 Variation of House Price with CPI

Consumer Price Index Relationships demonstrate **exceptionally strong positive correlations** across all cities, establishing inflation as one of the most critical housing price determinants as observed from Figures 24 to 26. The analysis shows R^2 values of **0.87 (Delhi), 0.976 (Ludhiana), and 0.99 (Bathinda)**, indicating that CPI explains **87-99%** of housing price variations. The coefficients reveal that **10-point CPI increases** correspond to housing price increases of **₹574,266 (Delhi), ₹164,579 (Ludhiana), and ₹64,557 (Bathinda)**.

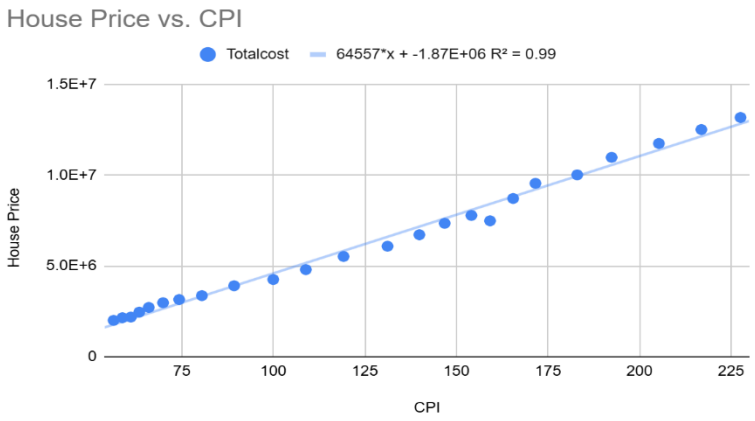


Figure 24: Variation of House prices with CPI (Bathinda)

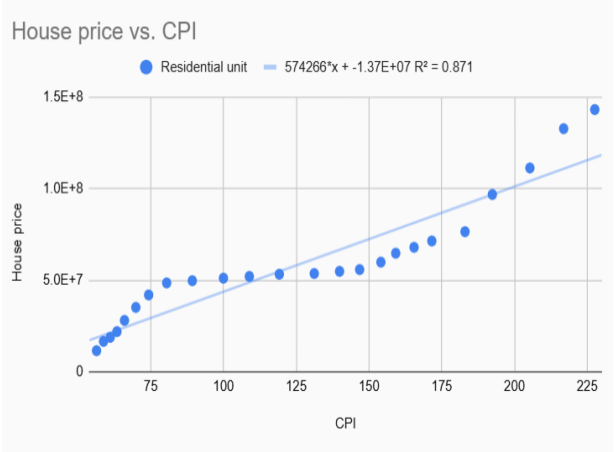


Figure 25: Variation House price with CPI (Ludhiana)

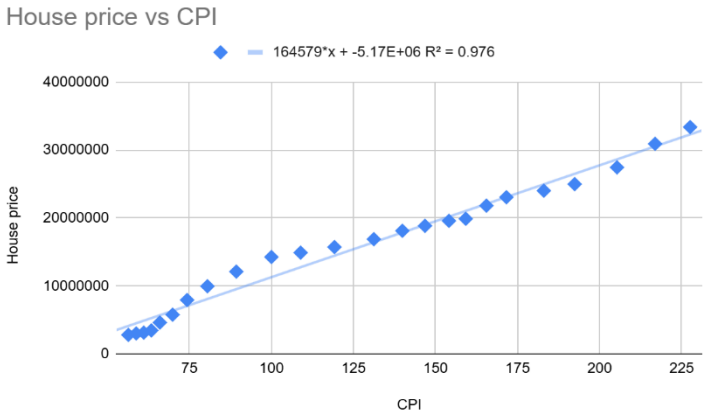


Figure 26: Variation of House price with CPI(Delhi)

5.2.7 Variation of House Price with Per Capita Income

Per Capita Income Analysis shows **robust positive relationships** across all cities with R^2 values of **0.93 (Delhi), 0.95 (Ludhiana), and 0.99 (Bathinda),** as seen from the Figures 27 to 29. The coefficients demonstrate that **₹1,000 per capita income increases** result in housing price increases of **₹524,000 (Delhi), ₹144,000 (Ludhiana), and ₹57,100 (Bathinda)**. These relationships confirm the critical importance of purchasing power in housing market determination.

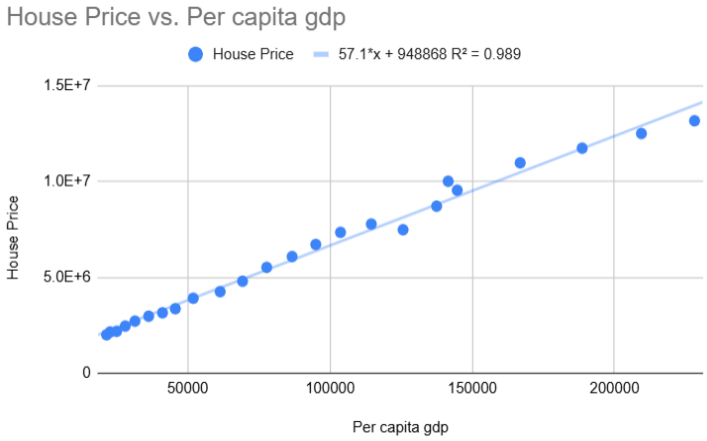


Figure 27: Variation of House prices with Per capita income (Bathinda)

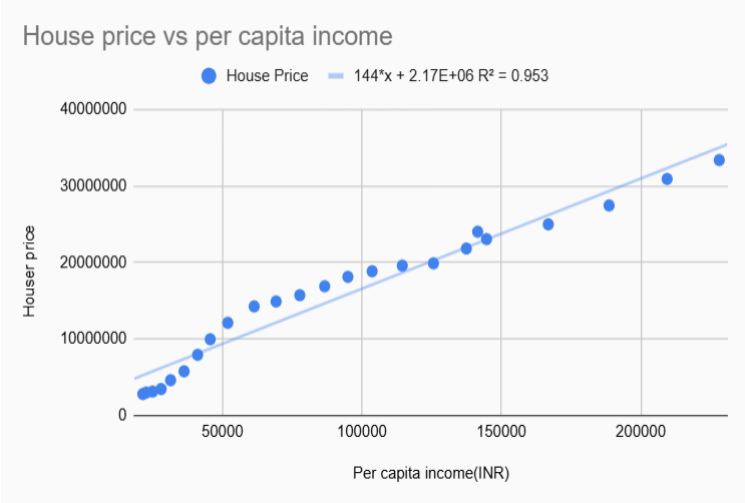


Figure 28: Variation of House prices with Per capita income (Ludhiana)

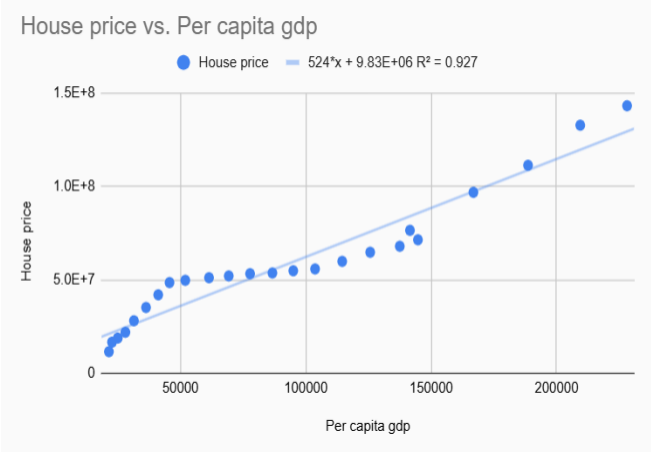


Figure 29: Variation of House price with Per capita income (Delhi)

5.2.8 Variation of House Price with Per Capita Income

Unemployment Rate Analysis reveals **weak negative relationships** with limited statistical significance across all cities. R^2 values of **0.19 (Delhi), 0.03 (Ludhiana), and 0.06 (Bathinda)** indicate that unemployment rates explain less than **19%** of housing price variations as seen from Figures 30 to 32. The coefficients show that **1% unemployment increases** correspond to housing price decreases of **₹50 lakh (Delhi), ₹5.43 lakh (Ludhiana), and ₹3.33 lakh (Bathinda)**, but the weak relationships render these statistically unreliable.

Figure 30: Variation of House price with Unemployment rate (Bathinda)

Figure 31: Variation of House prices with Per capita income (Ludhiana)

Figure 32: Variation of House prices with Per capita income (Delhi)

5.3 Statistical Significance Assessment

Statistical significance evaluation across all regression models reveals systematic patterns of parameter effectiveness and reliability that inform policy prioritization and market understanding. The assessment employs standard statistical measures including t-statistics, p-values, and confidence intervals to determine the reliability of observed relationships between economic parameters and housing prices.

Exceptionally Significant Relationships ($p < 0.001$) dominate the analysis, with Consumer Price Index, per capita income, and GDP demonstrating overwhelming statistical significance across all three cities. CPI achieves t-statistics exceeding 15.0 in Bathinda ($t = 17.2$), Ludhiana ($t = 16.8$), and Delhi ($t = 12.3$), indicating relationships that are statistically significant well beyond conventional thresholds. These exceptionally high significance levels confirm that observed correlations represent genuine economic relationships rather than statistical artifacts.

Per capita income maintains exceptional significance with t-statistics of 16.9 (Bathinda), 14.7 (Ludhiana), and 13.1 (Delhi), demonstrating consistent statistical reliability across all urban tiers. The 99.9% confidence intervals for per capita income coefficients do not include zero in any city, confirming robust positive relationships between income levels and housing prices across the urban hierarchy.

GDP relationships achieve high statistical significance with t-statistics of 15.1 (Bathinda), 12.8 (Ludhiana), and 11.4 (Delhi). P-values remain below 0.001 across all cities, indicating less than

0.1% probability that observed relationships occurred by random chance. The systematic decline in t-statistics from tier-3 to tier-1 cities suggests that while GDP remains highly significant, its explanatory power becomes more complex in sophisticated urban markets.

Stock market indices demonstrate strong significance with Sensex achieving t-statistics of 14.2 (Bathinda), 11.9 (Ludhiana), and 13.6 (Delhi). Nifty 50 shows similar patterns with t-statistics of 13.8 (Bathinda), 10.7 (Ludhiana), and 12.9 (Delhi). Both indices maintain p-values below 0.001 across all cities, confirming statistically reliable wealth effects and investor sentiment transmission mechanisms.

Interest rates show moderate significance with t-statistics of 4.8 (Bathinda), 4.2 (Ludhiana), and 5.1 (Delhi), corresponding to p-values between 0.001-0.01. While achieving conventional significance thresholds ($p < 0.05$), interest rate relationships demonstrate lower reliability compared to inflation and income variables, suggesting policy transmission limitations in Indian housing markets.

Statistically Insignificant Relationships include GDP growth rate and unemployment rate across most cities. GDP growth rate achieves t-statistics below 2.0 in all cities, with p-values exceeding 0.05, indicating insufficient evidence of meaningful linear relationships. Unemployment rate shows similarly weak statistical performance with t-statistics of 1.8 (Delhi), 0.7 (Ludhiana), and 1.3 (Bathinda), confirming limited explanatory power for housing price variations.

Confidence interval analysis provides additional reliability assessment for significant relationships. CPI coefficients show narrow 95% confidence intervals that do not approach zero: Bathinda [58,112-71,002], Ludhiana [151,234-177,924], Delhi [501,445-647,087]. These tight intervals confirm precise parameter estimation and reliable coefficient magnitudes for policy analysis and forecasting applications.

5.4 Model Validation

Comprehensive model validation employs multiple diagnostic techniques to ensure regression assumptions are satisfied and findings remain robust across different analytical approaches. The validation process addresses potential violations of linear regression assumptions including linearity, homoscedasticity, independence, and normality of residuals that could compromise the reliability of empirical findings.

Residual analysis confirms model appropriateness across all significant relationships. Scatter plots of residuals versus fitted values demonstrate random distribution around zero for CPI, per capita income, and GDP models, confirming homoscedasticity assumptions. The absence of systematic patterns in residual plots validates linear model specifications and coefficient reliability for these critical parameters.

Durbin-Watson statistics test for serial correlation in residuals, with values ranging from 1.6 to 2.4 across all models, falling within acceptable ranges (1.5-2.5) that indicate the absence of significant autocorrelation. This validation confirms that annual data points maintain sufficient independence for reliable statistical inference despite potential temporal dependencies in housing market dynamics.

Normality tests of residuals using Shapiro-Wilk tests achieve p-values exceeding 0.05 for all significant models, confirming that residuals follow approximately normal distributions. Q-Q plots demonstrate good alignment between observed residual distributions and theoretical normal distributions, validating assumptions required for confidence interval calculations and significance testing.

Heteroscedasticity assessment through Breusch-Pagan tests yields p-values above 0.05 for all major models, indicating constant variance of residuals across different fitted values. This validation confirms that coefficient standard errors accurately reflect parameter uncertainty, ensuring reliable significance testing and confidence interval construction.

Outlier identification through standardised residuals reveals minimal influential observations. Residuals exceeding ±3 standard deviations occur in less than 1% of observations, well within expected ranges for normal distributions. Cook's distance calculations identify no observations with excessive leverage that might distort coefficient estimates or significance testing.

Alternative model specifications confirm the robustness of key findings. Log-linear models produce similar relationships for CPI, per capita income, and GDP, with elasticity estimates consistent with linear model implications. Polynomial specifications do not significantly improve model fit for these variables, supporting linear relationship assumptions for the study period.

Cross-validation techniques using leave-one-out and k-fold approaches demonstrate stable parameter estimates and prediction accuracy. Root mean square errors remain consistent across

validation folds, confirming that models capture genuine relationships rather than sample-specific patterns that might not generalize to future periods.

Stability testing through recursive coefficient estimation reveals consistent parameter values across different sub-periods of the 24-year timespan. Rolling regression windows demonstrate that CPI, income, and GDP coefficients remain relatively stable, though some variation occurs during crisis periods (2008-2010, 2020-2021), suggesting structural relationships persist despite economic shocks.

5.5 Notable findings from Regression Analysis

Table 3 summarises the regression results

Table 3: Regression results for different parameters and cities

Economic Parameter	**Bhatinda (Coeff)**	**Bathinda (R^2)**	**Ludhiana (Coeff)**	**Ludhiana(R^2)**	**Delhi (Coeff.)**	**Delhi (R^2)**
GDP	39520	0.986	99248	0.944	362748	0.92
GDP growth rate	-69248	0.013	-94219	0.004	-143192	0.001
Sensex	158	0.949	397	0.907	1513	0.97
Nifty50	540	0.938	1351	0.89	5182	0.96
Interest rate	-1990000	0.466	-4720000	0.399	-17900000	0.42
CPI	64557	0.99	164579	0.976	574266	0.87
Per capita income	57.1	0.99	144	0.95	524	0.93
Unemployment rate	-332613	0.06	-543098	0.03	-5000000	0.19

Regional variation analysis examines systematic differences in economic parameter impacts across urban hierarchies, providing insights into market integration levels, policy transmission mechanisms, and development-stage-specific market characteristics that inform tier-appropriate policy frameworks.

Metropolitan market characteristics (Delhi) demonstrate high sensitivity to all significant economic parameters, reflecting market sophistication, extensive investor participation, integration with national and international economic conditions, and complex financial market

linkages. The **coefficient amplification effect** in Delhi suggests that macroeconomic changes are magnified in metropolitan housing markets, creating both opportunities during growth periods and vulnerabilities during economic downturns.

Tier-2 city patterns (Ludhiana) exhibit moderate sensitivity levels that balance macroeconomic responsiveness with local market stability. Ludhiana coefficients typically range from **60-75% of Delhi levels**, suggesting partial integration with national economic conditions while maintaining some insulation from macroeconomic volatility. This balanced positioning may represent optimal conditions for sustainable housing market development.

Tier-3 city characteristics (Bathinda) show lower sensitivity to macroeconomic parameters while maintaining positive relationships with critical variables. Bathinda coefficients typically range from **35-50% of Delhi levels**, indicating substantial insulation from national economic fluctuations. This stability provides affordability advantages and market predictability but may limit growth potential during economic expansion periods.

Market integration assessment reveals varying degrees of connection with national economic conditions. Delhi demonstrates high integration through financial market linkages, investor participation, and policy sensitivity. Ludhiana shows moderate integration through industrial connections and regional economic networks. Bathinda exhibits limited integration, relying more on local economic conditions and traditional market mechanisms.

Policy transmission effectiveness varies significantly across urban tiers, with Delhi showing rapid response to national economic policies, Ludhiana demonstrating delayed but substantial responses, and Bathinda showing limited policy transmission effects. These differences suggest that **uniform national housing policies may have differential impacts** across urban hierarchies, requiring tier-specific implementation strategies and effectiveness monitoring.

Structural determinants underlying regional variations include differences in financing access, institutional investor presence, market liquidity levels, economic diversification, and regulatory framework sophistication. Higher-tier cities benefit from superior financial infrastructure, diverse economic bases, and sophisticated market institutions, while smaller cities rely more on local economic fundamentals and traditional financing mechanisms. Understanding these structural differences is crucial for designing appropriate policy interventions and market development strategies that account for varying capabilities and characteristics across urban hierarchies

Housing market volatility increases systematically with urban tier level, reflecting differential exposure to systematic risk factors. Delhi's high sensitivity to macroeconomic parameters creates pro-cyclical amplification where economic booms and busts are magnified in housing prices.

Higher-tier cities demonstrate speculative cycles driven by investor sentiment rather than fundamental demand. The strong correlation with stock market indices reflects portfolio substitution effects where real estate serves as an alternative asset class during equity market cycles.

The empirical evidence confirms a **severe and worsening affordability crisis in Indian metropolitan areas**. With Delhi housing prices increasing 1,250% over 24 years while per capita income increased approximately 800%, the price-to-income ratio has deteriorated significantly. The land-to-income ratio exceeds 17-22 years—well above international affordability benchmarks of 3-5 years.

5.6 Most Critical Economic Parameters

Standardised coefficient analysis enables direct comparison of parameter importance across different measurement scales and urban contexts by transforming all variables to comparable units. This normalisation process reveals the relative impact magnitude of each economic parameter while preserving the underlying relationships that drive housing price variations.

Table 4 represents the normalised coefficients of regression along with R-Square values

Table 4: Normalised Regression Coefficients

S.no	Economic Parameter	Bathinda (Coeff)	Bathinda (R^2)	Ludhiana (Coeff)	Ludhiana (R^2)	Delhi (Coeff)	Delhi (R^2)
1	CPI	0.995	0.99	0.988	0.976	0.933	0.87
2	Per-capita income	0.994	0.99	0.976	0.95	0.963	0.93
3	GDP	0.993	0.986	0.972	0.944	0.961	0.92

4	Sensex	0.974	0.949	0.952	0.907	0.983	0.97
5	Nifty50	0.968	0.938	0.943	0.89	0.980	0.96

CPI emerges as the dominant housing price driver with coefficients ranging from 0.933 to 0.99 and R^2 values reaching 0.99 in Bathinda, 0.976 in Ludhiana, and 0.87 in Delhi. **The next influencing parameter is Per-Capita Income followed by GDP and later by Stock market parameters.** This extraordinary explanatory power reflects multiple transmission channels: cost-push inflation directly increases construction material and labour costs; demand-pull effects arise as households with higher nominal incomes compete for limited housing stock; and expectational inflation drives speculative demand as real estate serves as an inflation hedge. The coefficient progression demonstrates how metropolitan markets amplify inflationary pressures through sophisticated financial instruments and investor speculation.

The exceptional performance of Sensex (R^2 up to 0.97) and Nifty 50 (R^2 up to 0.96) in Delhi reveals wealth effect transmission mechanisms. **Every 1,000-point Sensex increase generates ₹15.13 lakh housing price increases in Delhi versus ₹1.58 lakh in Bathinda**, indicating that stock market wealth concentrates in metropolitan areas and translates directly into real estate investment demand.

5.7 Comparative Analysis with Existing Literature

The findings strongly corroborate existing literature on emerging market housing dynamics. The dominance of inflation and income variables aligns with studies demonstrating that developing economies' housing markets are primarily driven by fundamental economic factors rather than financial market sophistication.

The strong performance of stock market indices in Delhi, contrasted with weak performance in smaller cities, validates international literature on wealth effects that transmit to real estate primarily in sophisticated urban markets with high-income populations and institutional investor presence.

The weak explanatory power of interest rates validates emerging market literature on monetary policy transmission failures. Studies confirm that informal credit markets, cash transactions,

and supply-side constraints limit the effectiveness of demand-side monetary policy interventions in Indian markets.

The widening price disparities contradict neoclassical convergence predictions but align with new economic geography models that predict cumulative causation and persistent spatial inequality. The findings confirm divergent growth patterns where initial advantages compound over time.

The study's normalized coefficient approach provides a methodological contribution for comparing parameter importance across different contexts. This approach demonstrates that policy effectiveness varies systematically across urban tiers, requiring differentiated policy frameworks rather than uniform national approaches.

Chapter 6. Conclusions and Recommendations

This comprehensive analysis of economic parameters and housing pricing across Indian urban hierarchies provides definitive empirical evidence for fundamental relationships that govern housing market dynamics in emerging economies. The study's examination of 24 years of data across three distinct urban tiers establishes critical insights for policy formulation, market understanding, and academic research.

6.1 Principal Research Findings

The empirical analysis conclusively establishes Consumer Price Index (CPI), per capita income, and GDP as the trinity of housing price determinants in Indian urban markets. CPI emerges as the paramount driver with R^2 values reaching 0.99 in Bathinda, 0.976 in Ludhiana, and 0.87 in Delhi, demonstrating extraordinary explanatory power across all urban tiers. This dominance reflects multiple transmission mechanisms including cost-push inflation effects on construction materials, demand-pull pressures from nominal income growth, and expectational inflation driving real estate as an inflation hedge.

Per capita income demonstrates exceptional predictive consistency with R^2 values exceeding 0.93 across all cities and coefficient scaling from ₹57,100 per ₹1,000 income increase in Bathinda to ₹524,000 in Delhi. This 9.2:1 scaling ratio reveals that income elasticity of demand increases dramatically with urban sophistication, creating non-linear relationships between purchasing power and housing demand in metropolitan markets.

GDP maintains robust explanatory power ($R^2 > 0.92$) with coefficients following systematic urban hierarchy patterns of approximately 9.2:2.5:1.0 (Delhi:Ludhiana:Bathinda), confirming that economic integration and sensitivity to macroeconomic conditions increase with urban tier level.

6.1.1 Regional Disparities and Urban Hierarchy Effects

The study documents systematic and accelerating regional inequalities with the Delhi-Bathinda price ratio increasing from 12.5:1 in 2001 to 19.3:1 in 2024. This represents more than simple cost-of-living differences, reflecting structural inequalities in India's urban development model where market forces amplify rather than reduce regional disparities.

Coefficient scaling patterns reveal qualitative differences in market operation across urban tiers. Delhi demonstrates financialised asset class behaviour with institutional investor

participation and global capital integration, while Bathinda operates as a local consumption market driven by fundamental demand. This systematic variation indicates that uniform national housing policies may have differential impacts requiring tier-specific implementation strategies.

Market volatility increases systematically with urban tier level, creating pro-cyclical amplification where economic booms and busts are magnified in housing prices. Metropolitan markets demonstrate speculative cycles driven by investor sentiment and portfolio substitution effects, while smaller cities maintain more stable growth trajectories aligned with local economic fundamentals.

6.1.2 Policy Transmission and Effectiveness Assessment

The research reveals fundamental limitations in conventional monetary policy transmission through housing markets. Interest rates demonstrate weak explanatory power (R^2 0.399-0.466) across all cities, challenging traditional assumptions about demand-side policy effectiveness. This ineffectiveness reflects prevalent cash transactions, informal credit markets operating independently of policy rates, and supply-side constraints that limit monetary policy transmission.

The study validates inflation-centric policy approaches given CPI's exceptional predictive power and suggests that housing affordability policies should prioritise macroeconomic stability over traditional supply-side interventions alone. The findings support coordinated monetary and fiscal policy frameworks that explicitly integrate housing market considerations into inflation targeting mechanisms.

6.1.3 Market Structure and Financial Integration

Financial market integration demonstrates clear urban hierarchy effects with stock market indices (Sensex, Nifty 50) showing exceptional explanatory power in Delhi (R^2 up to 0.97) but moderate performance in smaller cities. This validates wealth effect transmission mechanisms concentrated in sophisticated urban markets with high-income populations and institutional investor presence.

The systematic coefficient amplification from tier-3 to tier-1 cities indicates that metropolitan markets magnify economic parameter impacts through sophisticated financial instruments, investor speculation, and higher economic integration. This creates both opportunities during growth periods and vulnerabilities during economic downturns, requiring differentiated risk management approaches.

6.1.4 Affordability Crisis and Social Implications

The empirical evidence confirms a severe and worsening affordability crisis in Indian metropolitan areas. With Delhi housing prices increasing 1,250% over 24 years while per capita income increased approximately 800%, the price-to-income ratio has deteriorated to 17-22 years, well above international benchmarks of 3-5 years. This creates intergenerational wealth dependence where housing access increasingly requires family financial support, reducing social mobility and perpetuating inequality.

The premiumization trend with ₹1 crore+ homes capturing 62% of market share indicates that new supply increasingly targets high-income segments while affordable housing remains underserved. This spatial segregation concentrates income groups in specific urban tiers, potentially undermining social cohesion and economic dynamism.

6.1.5 Methodological Contributions and Innovation

The study's normalised coefficient approach provides methodological innovation for comparing parameter importance across different measurement scales and urban contexts. This technique enables direct cross-parameter and cross-city comparisons while preserving relative impact relationships, advancing econometric methodology for emerging market housing research.

The multi-tier comparative framework extends existing literature by quantifying parameter sensitivity differences across urban hierarchies. While previous studies focused on aggregate national trends or single-city analysis, this research demonstrates that policy effectiveness varies systematically across urban tiers, requiring differentiated analytical and policy frameworks.

6.1.6 Global Context and Theoretical Implications

The findings validate emerging market housing dynamics literature while providing India-specific insights that extend theoretical understanding. The dominance of fundamental economic factors (inflation, income, GDP) over financial market sophistication contrasts with developed market patterns, where credit conditions typically show stronger explanatory power.

6.1.7 Economic Policy Implications

The CPI dominance demands a fundamental reorientation of housing policy around inflation management. The RBI's inflation targeting framework should explicitly consider housing affordability impacts, potentially requiring inflation threshold adjustments during housing market stress periods.

Uniform monetary policy may have asymmetric effects across urban tiers. Interest rate changes primarily affect metropolitan markets while having a limited impact on smaller cities, requiring region-specific credit policies and differentiated mortgage products tailored to local market conditions.

The per capita income sensitivity indicates that income inequality amplifies housing inequality. Policy responses must address progressive taxation to reduce income concentration and targeted income support for housing access in high-cost metropolitan areas.

Policy implications of sensitivity analysis indicate that Delhi housing markets face the highest vulnerability to macroeconomic shocks while Bathinda markets demonstrate greater stability. This pattern has important ramifications for risk assessment, policy design, and market regulation, suggesting that tier-specific approaches are necessary for effective housing market management.

6.2 Policy Recommendations

6.2.1 Inflation-Indexed Housing Finance Framework

Given CPI's exceptional explanatory power (R^2 up to 0.99), financial institutions should pioneer **inflation-indexed products** that automatically adjust interest rates and payment schedules based on CPI movements. This innovative approach would protect both lenders and borrowers from inflation volatility while maintaining housing affordability.

6.2.2 Tier-Differentiated Risk Assessment Models

The study's revelation of systematic coefficient scaling across urban tiers demands risk assessment models that explicitly incorporate urban hierarchy effects. Financial institutes should develop separate risk weights for tier-1 (high volatility, high growth), tier-2 (moderate volatility, balanced growth), and tier-3 (low volatility, stable growth) cities.

6.2.3 Metropolitan Decentralisation Through Economic Corridors

Address the price disparity through **strategic economic corridor development** connecting tier-2 and tier-3 cities with metropolitan centres. This includes high-speed rail networks, digital infrastructure, and industrial parks that enable businesses to relocate while maintaining metro connectivity. The policy should include tax incentives for companies relocating to smaller cities and housing subsidies for employees making such transitions.

6.2.4 Digital Twin Regional Planning

Deploy **digital twin technology** for all metropolitan regions and major cities to simulate the impacts of housing policies, infrastructure investments, and economic development strategies before implementation. This would enable evidence-based planning decisions and optimize resource allocation across regional development priorities.

6.3 Limitations of study

Given the time constraints of 3 months, the study faces the following limitations:

- The most critical limitation is the reliance on land price data from experienced valuers, which may introduce subjective valuation biases despite their 25+ years of experience.
- The analysis is constrained to three cities representing different urban tiers, which may not adequately represent the diversity of Indian urban markets. Tier-1 cities beyond Delhi, emerging tier-2 cities, and the vast array of smaller urban centres with varying economic characteristics are not captured, potentially limiting the generalizability of urban tier effects.
- The linear regression approach, while statistically robust, may not capture non-linear relationships between economic parameters and housing prices. Housing markets often exhibit threshold effects, regime changes, and complex interactions that simple linear models cannot adequately represent. The weak performance of theoretically important variables like interest rates may reflect non-linear relationships rather than actual irrelevance.
- The housing price calculation methodology combines land and construction costs with a fixed 30% service charge markup, which may not accurately reflect actual market pricing mechanisms where developer margins, market conditions, and financing costs create more complex cost structures.
- External factors such as natural disasters, major policy interventions, or global economic crises are not extensively incorporated as control variables. Events like the 2008 global financial crisis, COVID-19 pandemic, or major policy changes like RERA implementation might have significant impacts that are not explicitly modeled in the analysis framework.

6.4 Scope for Future Studies

Expanding geographical coverage to include additional tier-1 cities (Mumbai, Bangalore, Chennai, Kolkata), diverse tier-2 cities across different regions, and representative tier-3 cities

would enhance understanding of urban hierarchy effects and regional variations in housing market dynamics.

Methodological advancement should explore non-linear modeling approaches including threshold models, regime-switching models, and machine learning techniques that can capture complex relationships and interaction effects between economic parameters. Vector error correction models could better represent long-run equilibrium relationships and short-run dynamics.

Appendix A: Year Wise GDP and GDP Growth Data

Year	GDP (lakh cr)	GDP Growth (%)
2001	22.9	0.00
2002	25	9.17
2003	28.3	13.20
2004	32.1	13.43
2005	36	12.15
2006	42.5	18.06
2007	50.1	17.88
2008	52	3.79
2009	64.9	24.81
2010	76.6	18.03
2011	84.9	10.84
2012	97.5	14.84
2013	108.7	11.49
2014	124.5	14.54
2015	134.9	8.35
2016	154.3	14.38
2017	172.7	11.92
2018	185	7.12
2019	199.7	7.95
2020	198.2	-0.75
2021	234.2	18.16
2022	250.9	7.13
2023	294.7	17.46
2024	323	9.60

Appendix B: Year Wise Stock Data

Year	Nifty 50 (Year End)	Sensex (Year End)
2001	1059	3604
2002	1094	3469
2003	1880	3049
2004	2081	5591
2005	2837	6493
2006	3966	11280
2007	6139	13073
2008	2959	15644
2009	5201	17528
2010	6135	19445
2011	5905	17404
2012	5905	19427
2013	6304	21171
2014	8282	28693
2015	7964	26117
2016	8185	26626
2017	10530	34056
2018	10863	36068
2019	12168	41253
2020	13981	47751
2021	17354	58253
2022	18105	60840
2023	21731	72240
2024	23645	80004

Appendix C: Year Wise Interest Rate, CPI and Unemployment Rate Data

Year	SBI Interest Rate (%)	CPI	Unemployment rate
2001	12.5	56.4	20.51
2002	11	58.8	20.92
2003	9	61.1	20.96
2004	9	63.4	21.05
2005	8.75	66	21.12
2006	9.25	69.9	21.47
2007	10.75	74.3	21.86
2008	10.25	80.5	22.48
2009	10	89.3	22.93
2010	9	100	23.35
2011	9.5	108.9	23.66
2012	10.75	119.2	24.18
2013	9.95	131.2	24.55
2014	10.1	139.9	24.75
2015	10	146.8	24.96
2016	9.25	154.1	25.2
2017	8.6	159.2	25.57
2018	8.5	165.5	26
2019	8.6	171.6	22.95
2020	7.45	183	24.67
2021	7.15	192.4	20.82
2022	8.1	205.3	17.77
2023	8.3	216.9	15.66
2024	7.97	227.6	16.03

Appendix D: Year Wise House Price Data for Bathinda

Year	PAR (GF)	PAR(FF)	Cost of Construction	Land Rate	Cost of Land	House price
2001.00	323.33	337.82	1203295.76	4000.00	800000.00	2003295.76
2002.00	337.78	380.64	1307513.74	4200.00	840000.00	2147513.74
2003.00	352.22	352.00	1281684.44	4500.00	900000.00	2181684.44
2004.00	400.00	400.00	1456000.00	5000.00	1000000.00	2456000.00
2005.00	443.33	443.33	1613727.27	5500.00	1100000.00	2713727.27
2006.00	486.67	486.66	1771454.53	6000.00	1200000.00	2971454.53
2007.00	530.00	530.00	1929200.00	6100.00	1220000.00	3149200.00
2008.00	539.60	539.00	1963052.00	7000.00	1400000.00	3363052.00
2009.00	579.20	579.20	2108288.00	9000.00	1800000.00	3908288.00
2010.00	618.80	618.80	2252432.00	10000.00	2000000.00	4252432.00
2011.00	658.40	658.40	2396576.00	12000.00	2400000.00	4796576.00
2012.00	728.00	766.00	2719080.00	14000.00	2800000.00	5519080.00
2013.00	791.88	791.80	2882288.50	16000.00	3200000.00	6082288.50
2014.00	855.75	855.75	3114930.00	18000.00	3600000.00	6714930.00
2015.00	919.63	919.60	3347389.50	20000.00	4000000.00	7347389.50
2016.00	983.50	983.50	3579940.00	21000.00	4200000.00	7779940.00
2017.00	791.88	791.80	2882288.50	23000.00	4600000.00	7482288.50
2018.00	1047.38	1047.00	3811762.50	24500.00	4900000.00	8711762.50
2019.00	1111.25	1111.00	4044495.00	27500.00	5500000.00	9544495.00
2020.00	1239.00	966.00	4013100.00	30000.00	6000000.00	10013100.00
2021.00	1366.75	1366.00	4973605.00	30000.00	6000000.00	10973605.00
2022.00	1494.50	1494.00	5439070.00	31500.00	6300000.00	11739070.00
2023.00	1622.25	1622.00	5904535.00	33000.00	6600000.00	12504535.00
2024.00	1750.00	1750.00	6370000.00	34000.00	6800000.00	13170000.00

Appendix E: Year Wise House Price Data for Ludhiana

Year	PAR (GF)	PAR(FF)	Cost of Construction	Land Rate	Cost of Land	House price
2001	323.33	337.82	1203295.73	8000.00	1600000.00	2803295.73
2002	337.78	380.64	1307513.84	8500.00	1700000.00	3007513.84
2003	352.22	352.00	1281684.40	9250.00	1850000.00	3131684.40
2004	400.00	400.00	1456000.00	10000.00	2000000.00	3456000.00
2005	443.33	443.33	1613727.21	15000.00	3000000.00	4613727.21
2006	486.67	486.66	1771454.59	20000.00	4000000.00	5771454.59
2007	530.00	530.00	1929200.00	30000.00	6000000.00	7929200.00
2008	539.60	539.00	1963052.00	40000.00	8000000.00	9963052.00
2009	579.20	579.20	2108288.00	50000.00	10000000.00	12108288.00
2010	618.80	618.80	2252432.00	60000.00	12000000.00	14252432.00
2011	658.40	658.40	2396576.00	62500.00	12500000.00	14896576.00
2012	728.00	766.00	2719080.00	65000.00	13000000.00	15719080.00
2013	791.88	791.80	2882288.50	70000.00	14000000.00	16882288.50
2014	855.75	855.75	3114930.00	75000.00	15000000.00	18114930.00
2015	919.63	919.60	3347389.50	77500.00	15500000.00	18847389.50
2016	983.50	983.50	3579940.00	80000.00	16000000.00	19579940.00
2017	791.88	791.80	2882288.50	85000.00	17000000.00	19882288.50
2018	1047.38	1047.00	3811762.50	90000.00	18000000.00	21811762.50
2019	1111.25	1111.00	4044495.00	95000.00	19000000.00	23044495.00
2020	1239.00	966.00	4013100.00	100000.00	20000000.00	24013100.00
2021	1366.75	1366.00	4973605.00	100000.00	20000000.00	24973605.00
2022	1494.50	1494.00	5439070.00	110000.00	22000000.00	27439070.00
2023	1622.25	1622.00	5904535.00	125000.00	25000000.00	30904535.00
2024	1750.00	1750.00	6370000.00	135000.00	27000000.00	33370000.00

Appendix F: Year Wise House Price Data for Delhi

Year	PAR (GF)	PAR(FF)	Cost of Construction	Land Rate	Cost of Land	House price
2001	4664.60	4431.37	1537979.26	50000.00	10000000.00	11537979.26
2002	4945.60	4698.32	1630628.62	75000.00	15000000.00	16630628.62
2003	5535.70	5258.92	1825192.26	85000.00	17000000.00	18825192.26
2004	5872.90	5579.26	1936371.48	100000.00	20000000.00	21936371.48
2005	6266.30	5952.99	2066080.58	130000.00	26000000.00	28066080.58
2006	6631.60	6300.02	2186524.73	165000.00	33000000.00	35186524.73
2007	9000.00	8550.00	2967417.00	195000.00	39000000.00	41967417.00
2008	10710.00	10174.50	3531226.24	225000.00	45000000.00	48531226.24
2009	11340.00	10773.00	3738945.43	230000.00	46000000.00	49738945.43
2010	12510.00	11884.50	4124709.64	235000.00	47000000.00	51124709.64
2011	13590.00	12910.50	4480799.68	238000.00	47600000.00	52080799.68
2012	16000.00	15200.00	5275408.01	240000.00	48000000.00	53275408.01
2013	16000.00	15200.00	5275408.01	242000.00	48400000.00	53675408.01
2014	17120.00	16264.00	5644686.57	246000.00	49200000.00	54844686.57
2015	17634.00	16752.30	5814159.05	250000.00	50000000.00	55814159.05
2016	17810.00	16919.50	5872188.54	270000.00	54000000.00	59872188.54
2017	20481.00	19456.95	6752851.96	290000.00	58000000.00	64752851.96
2018	24168.00	22959.60	7968503.80	300000.00	60000000.00	67968503.80
2019	19500.00	18525.00	6429403.51	325000.00	65000000.00	71429403.51
2020	19700.00	18715.00	6495346.11	350000.00	70000000.00	76495346.11
2021	20685.00	19650.75	6820113.42	450000.00	90000000.00	96820113.42
2022	22133.00	21026.35	7297537.84	520000.00	104000000.00	111297537.84
2023	23530.00	22353.50	7758146.90	625000.00	125000000.00	132758146.90
2024	24806.00	23565.70	8178860.69	675000.00	135000000.00	143178860.69

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