Regional Patterns of Housing Price Gaps in Russia

ROSHCHINA IANINA, PhD
Associate Professor, Faculty of Economics, MSU–BIT
LITVINOVA ANNA, YANDEX
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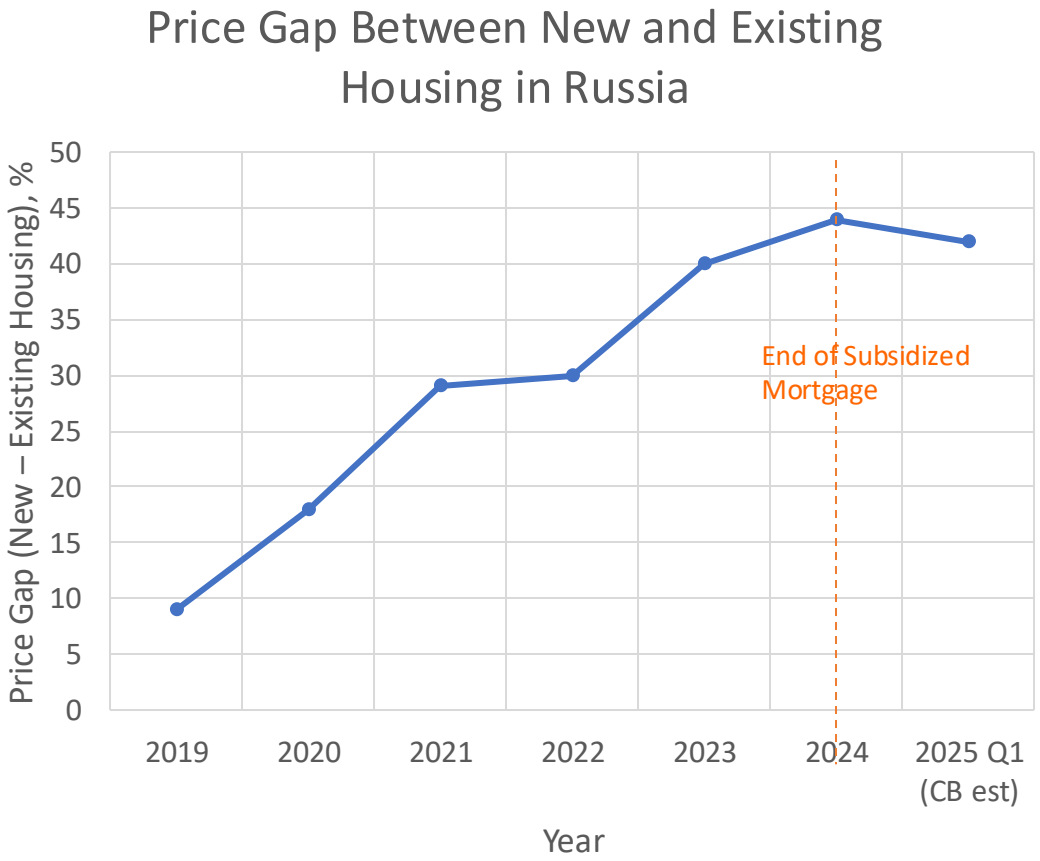
Motivation

- Housing market ≈ 13% of Russia's GDP (key economic sector)
- Price gap between new and existing housing grew from 9% (2019) to 44% (2024)
- Why it matters:
  - **Households:** investment and mortgage decisions
  - **Regulators:** housing affordability and financial stability
  - **Developers:** competitiveness of new projects
- Regional differences and institutional factors remain underexplored
- This study combines big-data integration and econometric modeling



Two-Stage Research Design

Stage 1: measuring Price Gap

- Data: 22.2M listings (2022–2025)
- Matching pairs of apartments with similar characteristics
- Price gap formula:

$$\Delta P = P_{primary} - P_{secondary}$$

- Output: regional mean price gaps

Stage 2: explaining Price Gap

- Panel dataset (2022–2025)
- Econometric models: FE, SAR, SEM, SARAR
- Equations:

$$Gap_{it} = \alpha_i + \lambda_t + \beta_1 DevConc_{it} + \beta_2 BankComp_{it} + \beta_3 Policy_{it} + \gamma Z_{it} + \varepsilon_{it}$$

Data Overview

- **Large-scale dataset:** 22.2 million housing sale listings
- **Sources:** combines microdata from real estate platforms and macro indicators from public sources
- **Main categories of variables:**
  - Housing characteristics (price, area, number of rooms, building type, floor)
  - Regional macroeconomic indicators (GRP, wages, unemployment)
  - Financial and institutional variables (mortgage rates, credit access, developer concentration, housing construction activity)
- **Integration:** merged at regional level → balanced panel for econometric & spatial analysis
- **Coverage:** Russian regions, 2022–2025 Q1

Online Platforms | Public Statistics | Financial Data & Construction Data | → Regional Panel Dataset

Data Sources and Key Indicators

Source	Type of Data	Key Variables / Indicators	Frequency
Cian, Avito, Yandex Real Estate	Online listings (primary & secondary markets)	price per m^2, area, rooms, building type, floor, location	Daily (aggregated to quarterly)
Unified Developers Resource	Construction data	number of developers, market share of largest developer, construction speed, HHI index (own calculations)	Monthly (aggregated to quarterly)
DOM.RF	Mortgage programs	loan volumes under “Family Mortgage”, “Far East Mortgage”, “IT Mortgage”	Monthly (start of quarter)
Central Bank of Russia	Financial statistics	mortgage rate, loan terms, number of credit institutions per 1 M people, loan volume	Monthly / Quarterly
Rosstat	Regional macroeconomic and demographic indicators	income per capita, unemployment, population, GRP, CPI, migration rate	Quarterly / Annual
RIA Rating & EMISS	Regional housing and affordability indicators	housing affordability index, average apartment price (60 m^2), new housing commissioned per 1 000 people	Annual
Own calculations	Derived indicators (based on microdata)	regional price gap between primary and secondary markets	Quarterly (2022–2025)

Matching Methodology

- Two-stage matching to ensure comparability (control for differences in key features)
- **Stage 1 (Spatial Matching)**: pair apartments located within a radius r ensuring spatial proximity
  - Radius was tested in several variants (100 m, 200 m, 300 m, 500 m)
  - Final value **r = 300 m** was selected as a trade-off between accuracy and sample size
- **Stage 2 (Attribute Matching)**: select pairs with similar characteristics
  - Distance metric: $d(x_i, x_j) = \sqrt{\sum_k w_k (x_{ik} - x_{jk})^2}$
  - Apartments are matched if $d < \delta$
  - In practice, matching was based on threshold conditions (e.g. ≤ 300 m distance, ≤ 10–15 % difference in area, same number of rooms and building type), rather than explicit weights w_k
- **Alternative specification**: price gap was also estimated for apartments in the same residential complex (different buildings, one completed and one under construction) to test robustness
- After matching, mean differences in characteristics are minimized – samples of new and existing housing become balanced

Number of Matched Pairs for Moscow

Radius, m	Approach 1: Different Buildings within Given Radius	Approach 2: Same Residential Complex (Different Buildings)
100	4 601	2 271
200	8 496	3 676
300 (baseline)	**11 413**	**4 244**
500	15 555	4 562

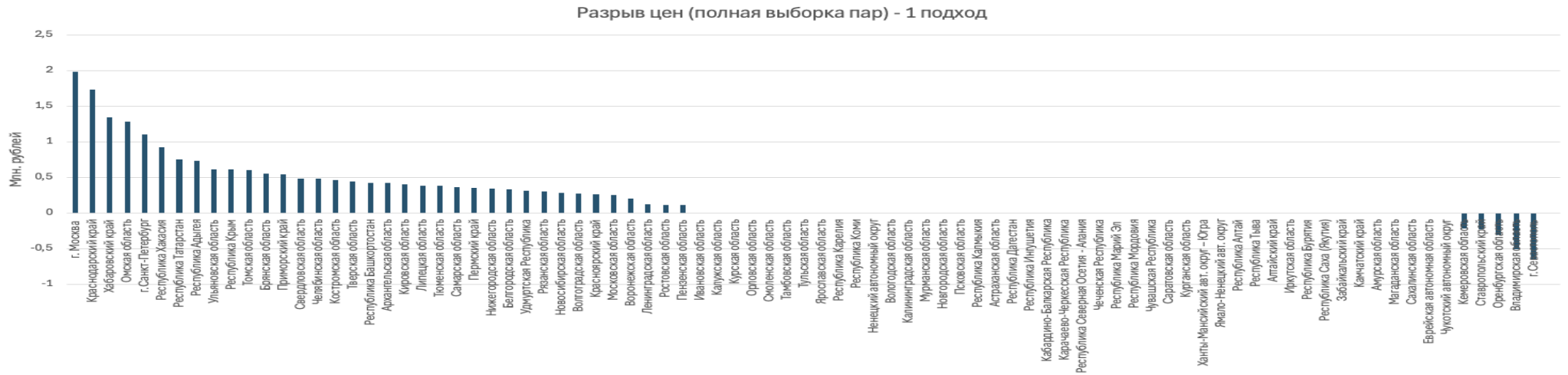
Regional distribution of the number of matched apartment pairs (per region, radius = 300 m):

Approach 1			**Approach 2**		
Min	**Mean**	**Max**	**Min**	**Mean**	**Max**
50*	2 416	11 413	50*	1 175	4 244

**Artificial minimum of 100 matched pairs per region was set for price gap estimation*

Regional Variation in Price Gaps

- Regional price gaps were estimated using matched pairs within 300 m (Approach 1) and within the same residential complex (Approach 2)
- Many regions show a **positive price gap** (new housing more expensive than existing)
- Many regions show **zero (statistically insignificant) gap**
- A few regions show **negative gap**, often due to infrastructure or location differences
- Moscow & St Petersburg — consistently positive gap, stable over time
- Heterogeneity confirms that national-level averages mask significant regional variation



Regional Variation in Price Gaps (App 2)

Regional Patterns and Conceptual Framework

- Regions with positive price gap:
  - higher average apartment prices
  - larger mortgage volumes
  - greater housing affordability
- This indicates structural differences between regional housing markets
- What are the explaining factors?
  - Macroeconomic factors: regional income, inflation, unemployment, mortgage rates
  - Industry factors: developer concentration, construction costs, market competition
  - Financial factors: bank competition, availability of mortgage
  - Institutional / policy factors: preferential mortgage programs, regional housing initiatives
- Combined, these factors shape both demand and supply, affecting how prices are formed in primary and secondary housing markets

Panel model Results (Fixed Effect)

- Several specification tests were performed: Hausman (FE vs RE), Breusch–Pagan (RE vs Pooled), and a special test comparing “short” and “long” regressions (FE vs Pooled). All tests (at the 5% significance level) unambiguously supported the Fixed Effects (FE) specification
- So we choose FE Panel model captures both regional (α_i) and time (λ_t) fixed effects:

$$gap_{it} = \alpha_i + \lambda_t + \beta_1 DevConc_{it} + \beta_2 BankComp_{it} + \beta_3 Policy_{it} + \gamma z_{it} + \varepsilon_{it}$$

- Model validity tests confirmed overall significance and robustness of results
- Regions with insufficient data for price gap estimation were excluded
- The models were also tested for robustness with and without Moscow and St Petersburg, results remained stable. We retain these regions as their specific effects are captured by FE and data volume is limited
- Results obtained using two approaches are generally consistent. For clarity, only estimates from Approach 1 are reported, as this specification is based on a larger and more reliable dataset
- The table next slide presents only statistically significant variables

Panel model Results (Fixed Effect)

Dependent variable: regional price gap, thousand rubles

Variable	Expected sign	Coefficient (β)	Std. error
Per capita income	+	0.01 **	(0.003)
Construction speed (days per building)	+	0.4 ***	(0.1)
CPI	–	–6.8 **	(3.2)
Commissioned dwellings per 1 000 people	–	–0.4 **	(0.2)
# of credit institutions issuing mortgages (per 1 M people)	–	–273.5 **	(116.2)
Mortgage volumes	–	–0.01 ***	(0.001)
Max market share of a single developer	+	537.8 *	(312.3)
Family Mortgage (loans amount)	+	0.04 ***	(0.01)

Fixed-effects panel model, quarterly data for 2022 – 2025 Q1
*SE in parentheses; *** p < 0.01, ** p < 0.05, * p < 0.10*

Spatial Dependence and Model Specification

- Price gaps may show spatial dependence – neighboring regions share similar economic and institutional conditions
- Ignoring this could bias regression estimates and understate regional spillovers
- To account for this, 3 spatial panel models were estimated:
  - SAR (Spatial Autoregressive model):

$$y = \rho W y + X\beta + \varepsilon$$

  - SEM (Spatial Error model):

$$y = X\beta + \lambda W\varepsilon + \nu$$

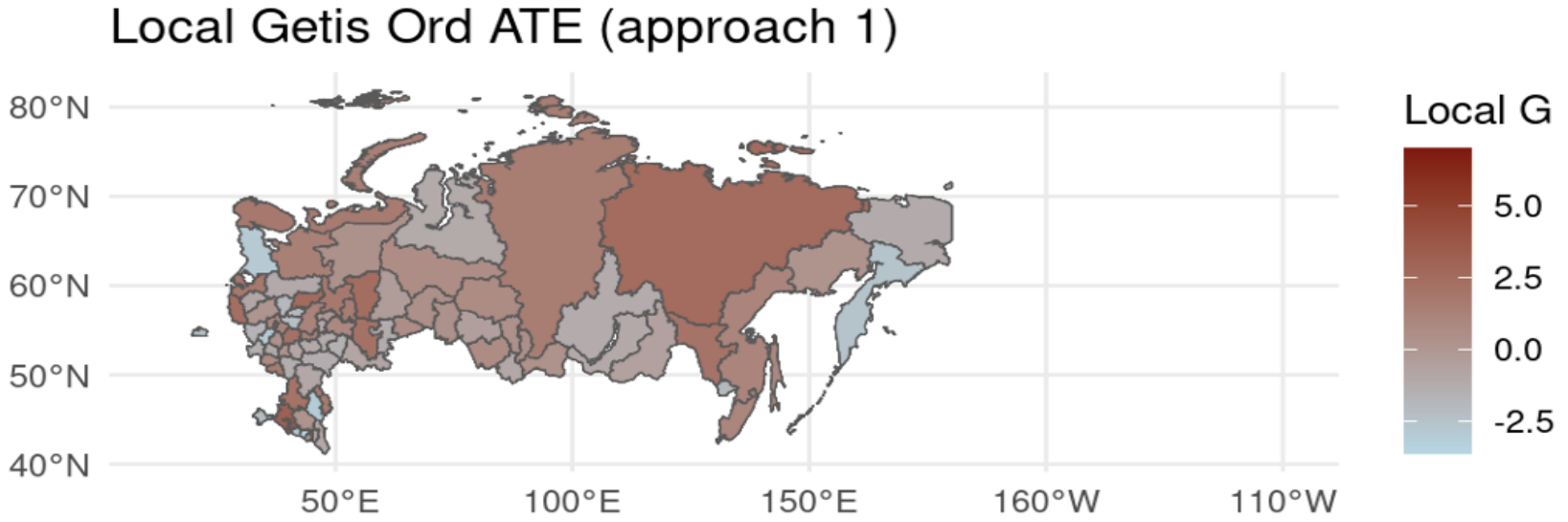
  - SARAR (combined model):

$$y = \rho W y + X\beta + \lambda W\varepsilon + \nu$$

- W — row-standardized spatial weights matrix (based on inverse distances between regional centroids)
- Spatial dependence tested using Moran's statistic is positive and significant ($p < 0.01$)
- Need to use SAR/SEM/SARAR specifications to capture cross-regional interactions

Spatial Clustering of Regional Price Gaps

- The Moran's I statistic for both price gap measures is positive and significant, indicating the presence of positive spatial autocorrelation
- While Moran's I detects overall spatial clustering, it does not distinguish between clusters of high and low values
- To identify and visualize such local clusters, the **Getis–Ord Gi*** statistic is applied (its spatial distribution is shown below)



map shows local spatial clusters of the price gap between new and existing housing

Spatial Dependence and Model Specification

- To select the most appropriate specification, several diagnostic tests were performed, including the Lagrange Multiplier tests for spatial panels (Baltagi, Song & Koh)
- Based on the significance of spatial parameters (λ, ϕ, ρ) and model coefficients, the fixed-effects specification was preferred
- All three spatial models produced similar results, and the SARAR model was selected as the most comprehensive
- As in the panel FE analysis, results are reported for Approach 1, with only statistically significant variables shown in the next table

Spatial model Results (SARAR FE)

Dependent variable: regional price gap, thousand rubles

Variable	Expected sign	Coefficient (β)	Std. error
Per capita income	+	0.00 **	(0.00)
Construction speed (days per building)	+	0.4 ***	(0.1)
Commissioned dwellings per 1,000 people	–	–0.3 **	(0.2)
# of credit institutions issuing mortgages (per 1 M people)	–	–253.7 **	(107.2)
Mortgage volumes	–/0	0.00 ***	(0.00)
Max market share of a single developer	+	519.1 *	(281.6)
Spatial lag ρ	+	0.70 ***	(0.08)

SARAR FE panel model, quarterly data for 2022 – 2025 Q1
*SE in parentheses; *** p < 0.01, ** p < 0.05, * p < 0.10*

Key Results

- Positive price gap prevails across most Russian regions
- Gap varies spatially, forming clusters of high and low values (confirmed by I and Gi* tests)
- Lower developer competition (higher market concentration) widens the price gap
- Greater bank competition and higher mortgage volumes reduce the gap by improving credit access
- Family Mortgage program increases the gap, stimulating demand for new housing
- Macroeconomic and structural factors (income, construction speed, housing supply) significantly affect the gap, though direction and magnitude differ across regions
- Macroeconomics spatial dependence is positive and significant, meaning regions with high gaps tend to be surrounded by similar regions

Results are robust across panel and spatial specifications (2022–2025 Q1)

Interpretation

- The results reflect the dual structure of Russia's housing market:
  strong state support and concentrated supply on the primary market vs. fragmented secondary supply
- Developer competition reduce the gap
- Bank competition and broader mortgage access reduce the gap
- The Family Mortgage program raises demand for new housing, temporarily increasing the gap
- Higher income and slower construction drive larger price gaps
- More commissioned dwellings narrow the gap by easing local market pressure
- Positive spatial dependence shows regional housing markets influence each other

The widening gap stems from structural asymmetries, credit policies, and regional spillovers

Policy and market implications

- Enhance competition among developers through regulatory measures and incentives to limit market concentration
- Promote fair mortgage access by expanding regional bank networks and reducing lending rate disparities
- Adjust preferential mortgage programs to consider regional differences and possible side effects on prices
- Monitor regional price gaps as an indicator of housing market stability and efficiency of policy interventions
- Use spatial analysis in housing policy design to capture interregional spillovers and prevent localized overheating

- *Findings highlight the importance of considering both market structure and regional context in housing policy decisions*

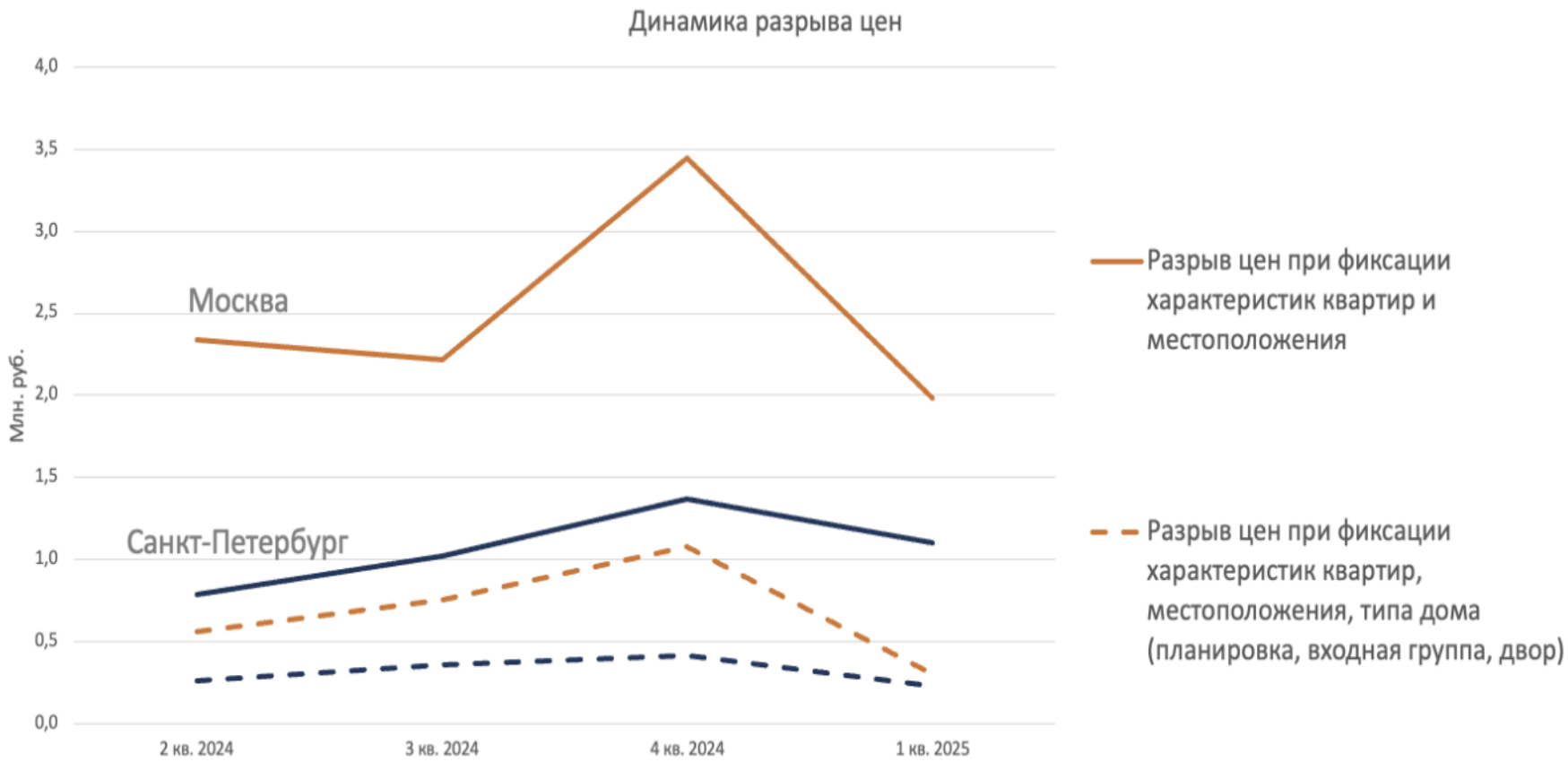
Thank you!

Literature Review (I): General Research on Housing Markets

- Housing price modeling and dynamics: key indicators and trends in Russian and international markets
  (Volkov, 2022; Klochkova & Tolstyakova, 2019; Petrova, 2023)
- Valuation and forecasting methods: neural networks, machine-learning models, and text-based data
  (Yasnitsky et al., 2022; Goncharov & Natkhov, 2020; Bogdanova et al., 2020)
- Data sources: administrative registries and web platforms (CIAN, Avito, Yandex Realty) improve coverage of transactions
  (Dukhon et al., 2021; Berdnikova, 2021)
- Mortgage and housing policy: affordability, state-supported programs, and effects on demand
  (Sternik & Apalkov, 2015; Mishura, 2023; Roshchina & Ilyunkina, 2021)

Literature Review (II): Primary vs Secondary Markets and Price Gaps

- Primary vs secondary markets: differences in price formation and determinants
  (Leszczynski & Olszewski, 2017; Dittmann, 2013; Tomal, 2019)
- Convergence and spatial effects: panel and cointegration tests show limited long-term convergence
  (Montagnoli & Nagayasu, 2015)
- Filtering and ripple effects: inter-market spillovers and migration-driven price waves
  (Brzezicka et al., 2019; Grigoryeva & Ley, 2019)
- Bubbles and anomalies: detection of housing price “bubbles”
  (Galenkova et al., 2019; Kosyakina, 2023; Bayer et al., 2021)
- Gap studies in other markets: used for cars, art, and technology; housing research remains limited
  (Akerlof, 1970; Frey & Eichenberger, 1995; Zhou & Gupta, 2020)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