Bubbles on the Steppe

Intrinsic Bubbles and Credit Expansion in Kazakhstan's Real Estate Market

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Main Points

- Monthly new and existing housing prices and economic variables from 2000-2017 (a boom and bust cycle)

- Bubble detected 2002-07 (used housing); 2002-04 (new)
  - Used Phillips (2015) BSADF statistic to date-stamp bubble regimes
  - No evidence of rational speculative bubbles as in van Norden and Schaller (1993, 1999).
    - Regime switching model between bubble and non-bubble state
  - Evidence of intrinsic bubbles as in Froot and Obstfeld (1991)
    - Overreaction to changes in fundamentals

- Larger bubble in existing housing
- Evidence for a policy induced credit boom

Outline

I. Background
II. Data
III. Analysis
IV. Bubble identification
V. Rational Speculative Bubbles
VI. Intrinsic Bubbles
VII. Final thoughts

I. Background

- Why Kazakhstan?
  - Kazakhstan is arguably the richest and most successful country in the CIS region due to its abundant oil wealth
  - Has experienced enormous economic growth and increase in real incomes since independence in 1991.
  - Fastest transition to a market economy and largest expansion of the housing market among CIS countries.
  - Housing, mortgage, and construction markets show characteristics of credit fueled expansion
  - Large increase in housing prices and real-estate construction.
  - GREAT DATA, both nationally and now from www.krisha.kz

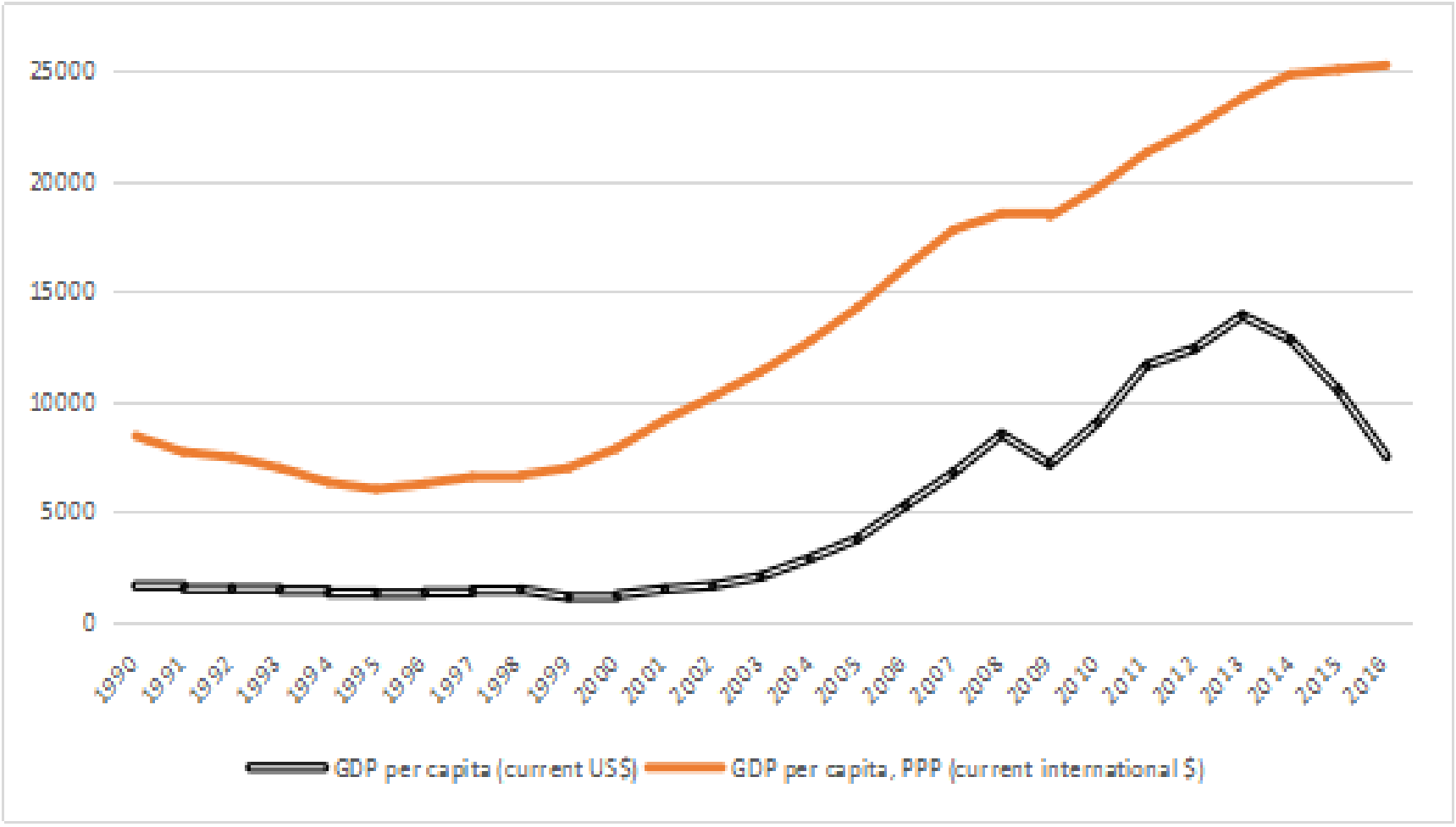
Facts

- Spectacular growth between 1999 and 2007.
- Unemployment steadily declined from 12.8% in 2000 to 7.3% in 2007 and to 4.9% in 2016
- From 2004 on, net recipient of international migration.
- Per capita GDP rose from $1,130 in 1999 to $6,771 in 2007, a six-fold increase (25% annual growth)
- In PPP terms, a 154 per cent increase (12% annual growth) from $7,003 to $17,793

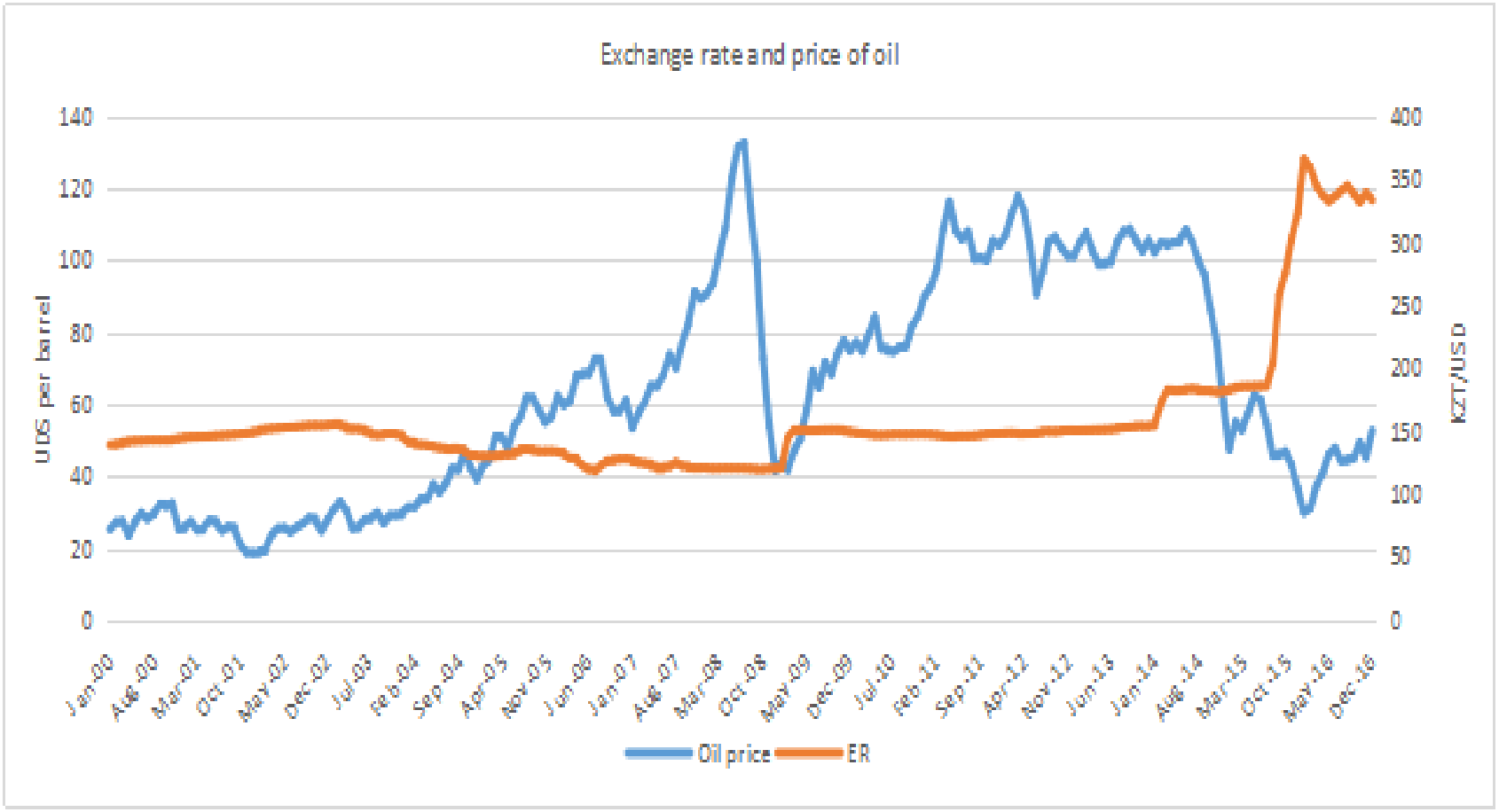
Facts

- Significant impact of the global financial crisis and fluctuations in oil prices on Kazakhstan's economy.
  - Economy slowed considerably in the aftermath of the 2007 financial crisis
  - Sharp decrease in oil prices in 2008 exacerbated the decline
  - Growth resumed in 2010 at around 5% annually when the price of oil started to rise again, but decreased with oil prices from 2015 on.
- Two high-inflation episodes –2007, 2015
  - Former coincides with global crisis
  - Latter with depreciation of the *tenge*

GDP per capita



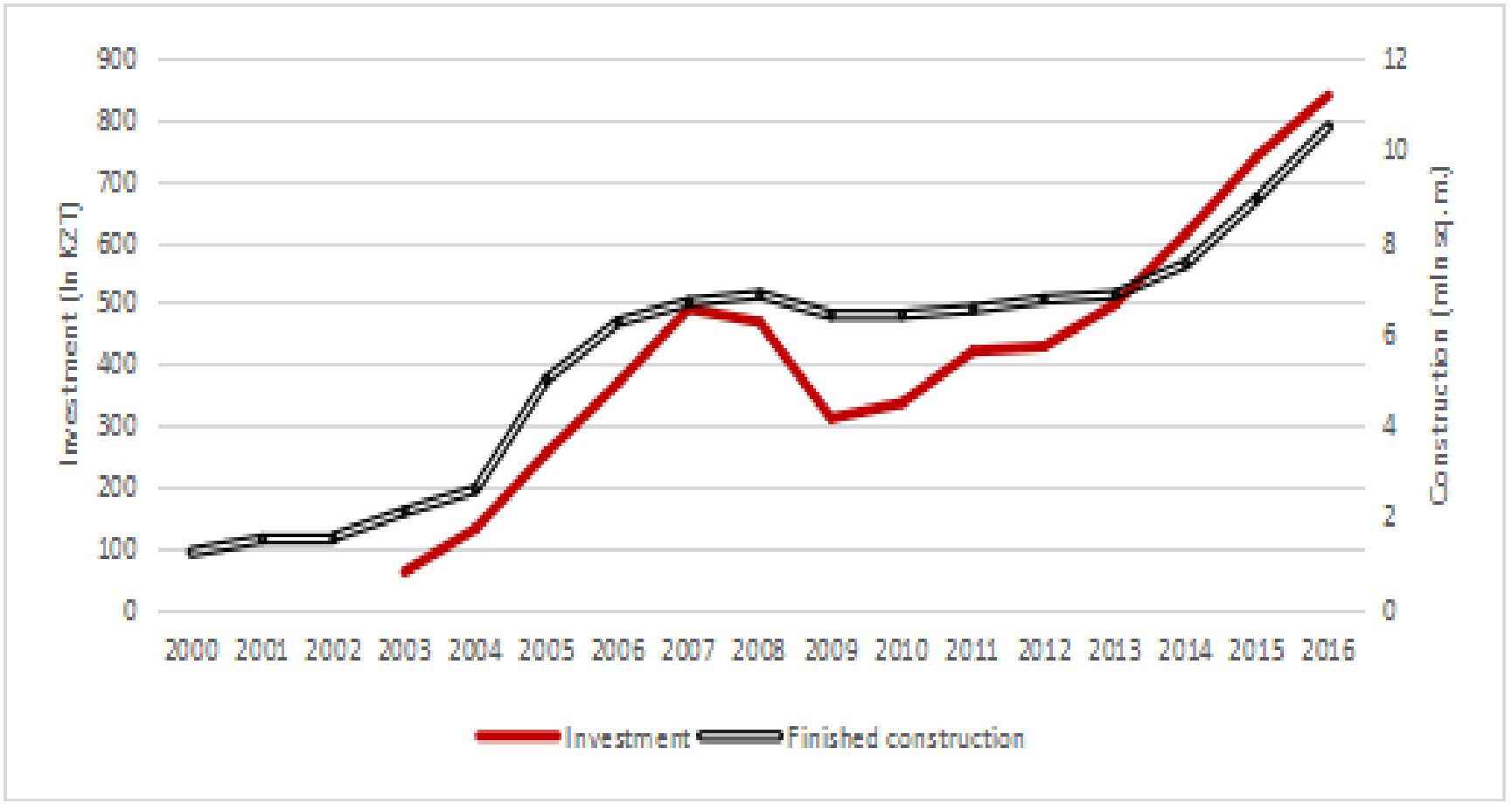
Exchange rate and Oil Prices



The Housing Market

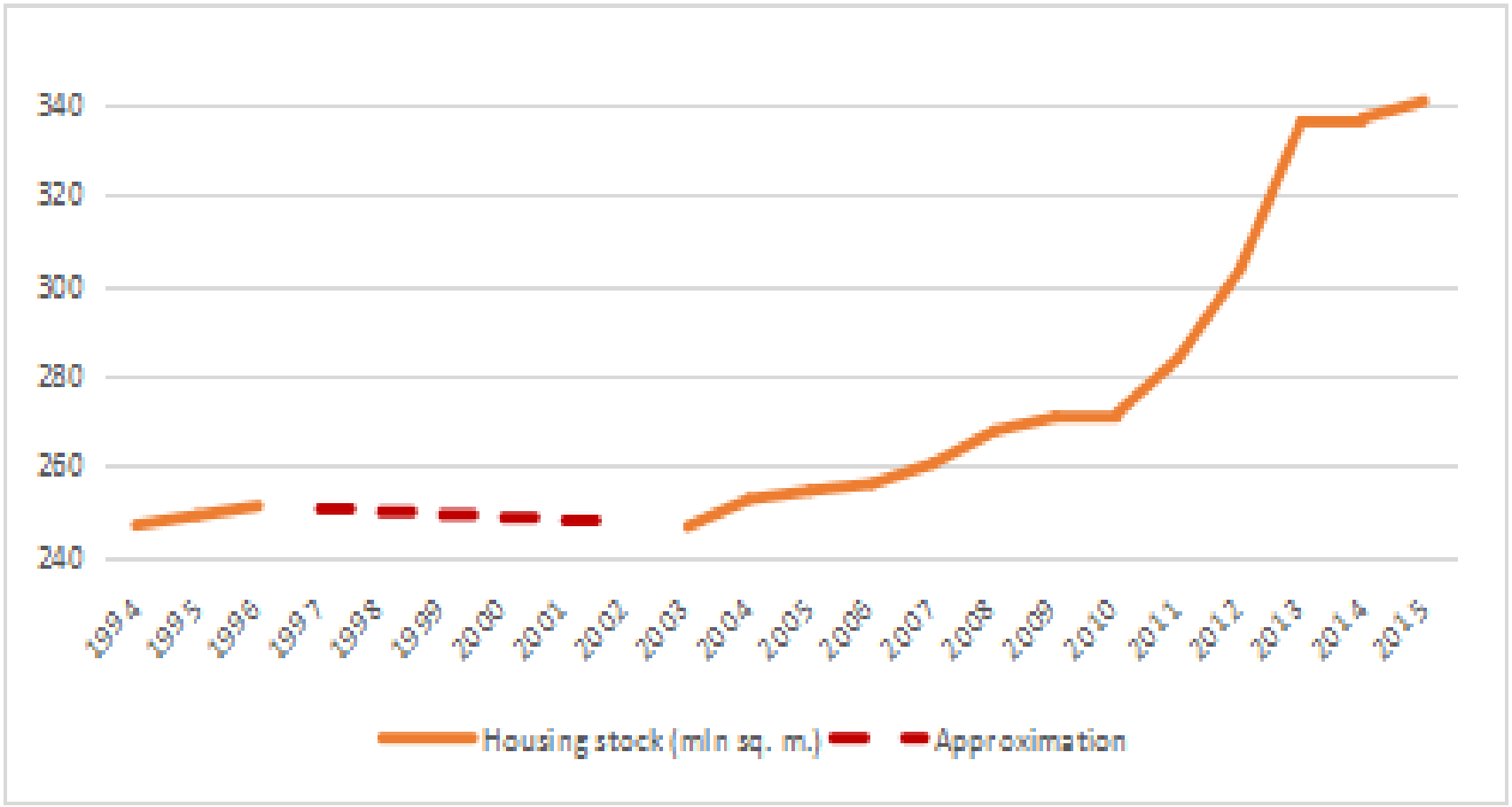
- During the Soviet era people lived in public housing supplied by the state with long waiting lists.
- Low priority on housing provision so residences were in short supply.
- After independence, privatization of housing, and creation of housing markets.
- Prices rose non-stop for eight years
  - Demand for housing and tight supply
  - Over-borrowing in the financial sector
  - Rising Incomes
  - Increased marriage and birth rates
  - Influx of workers
  - Limited Investment opportunities (small stock market & forced savings)
  - Relocation of capital from Almaty to Astana

Housing Investment and Finished Construction



Housing Stock

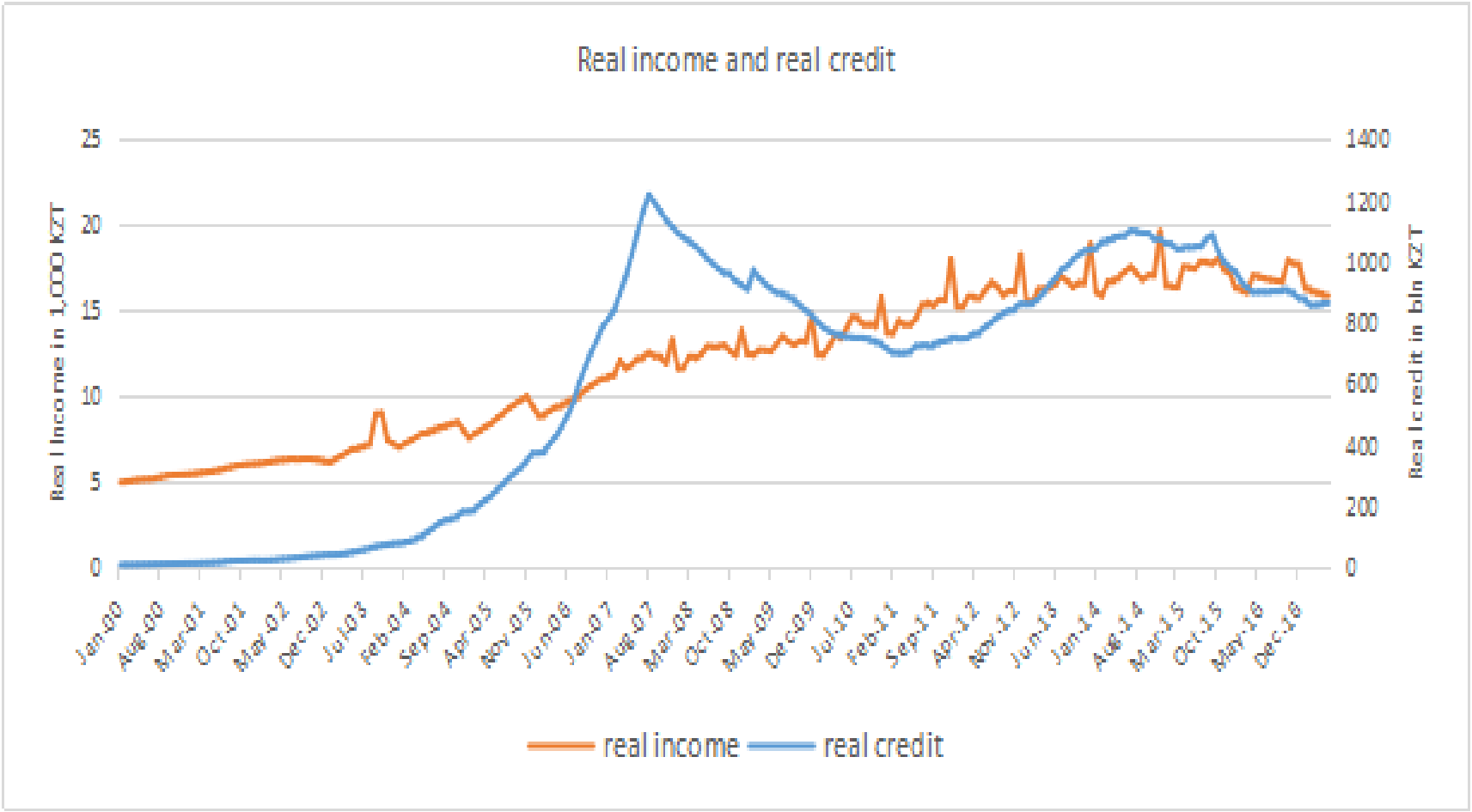
note the lag in supply relative to boom years



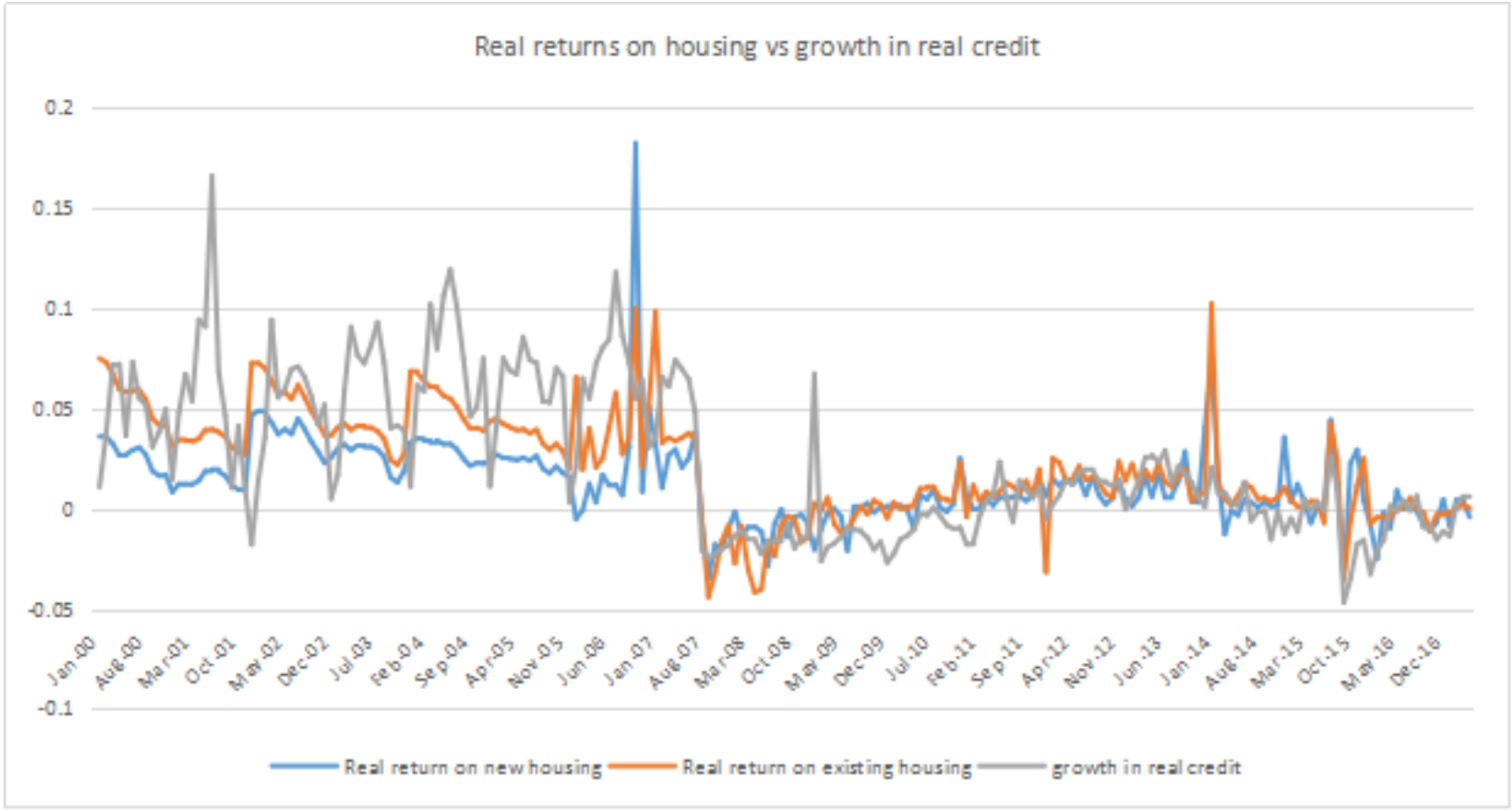
Credit expansion fuels market

- 70% of borrowed funds channeled to the construction sector and mortgage market.
- Total external debt reached USD 66.8 billion or 44% of GDP in 2007
- Government established a state-owned mortgage company (Kazakhstan Mortgage Company, KMC) in 2001 to provide affordable housing.
- KMC purchases mortgage loans and issues mortgage-backed securities.
  - *Volume of mortgages more than doubled annually during the period 2004-06, and more than 80% of apartments purchased through real estate companies were through bank borrowing*
- From 2004 and 2007, the amount of annual housing construction increased from 3 to 7 million square meters, a more than 32% annual increase

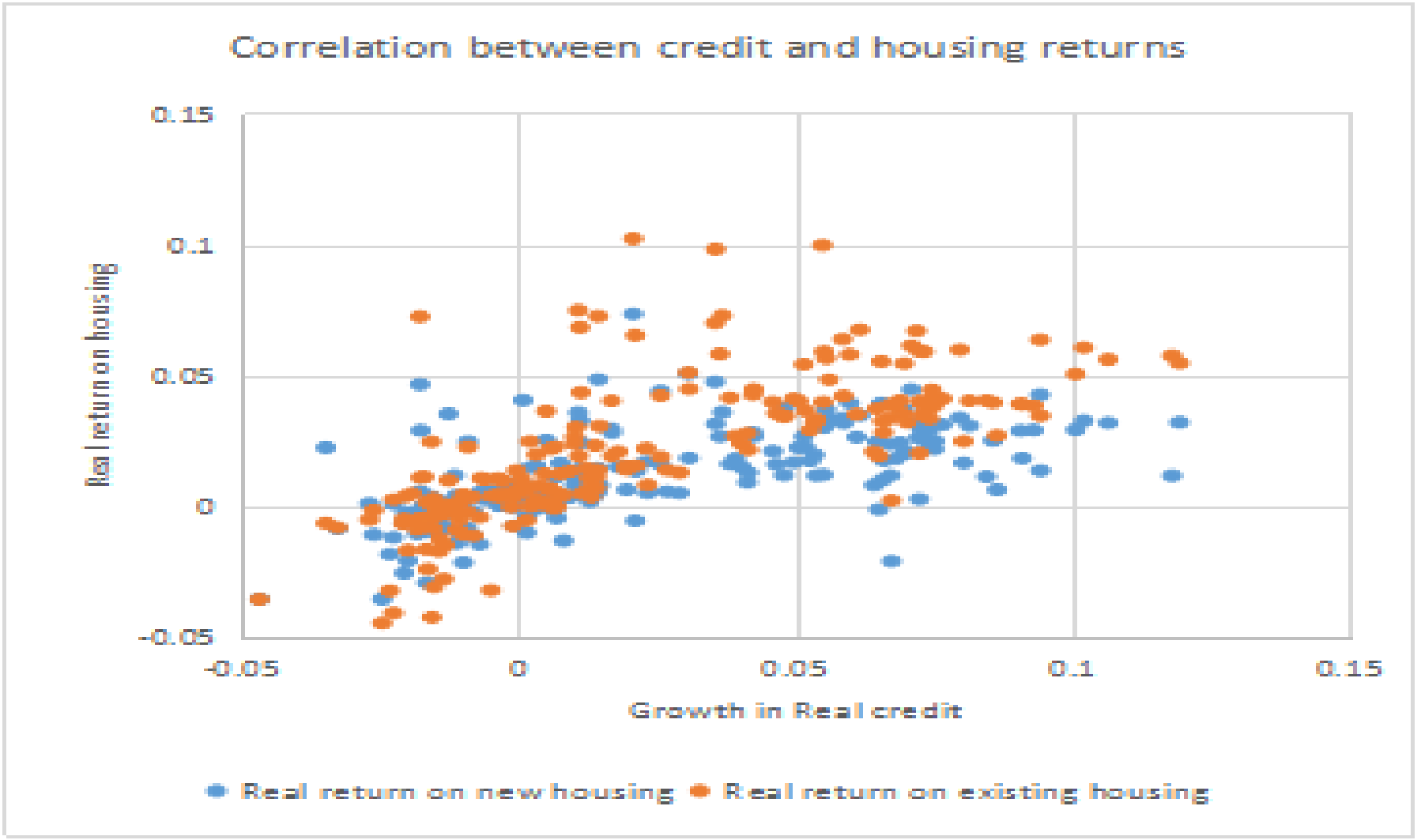
Real Income and Credit



Real Housing Returns and real credit growth



Correlation between Housing and credit growth



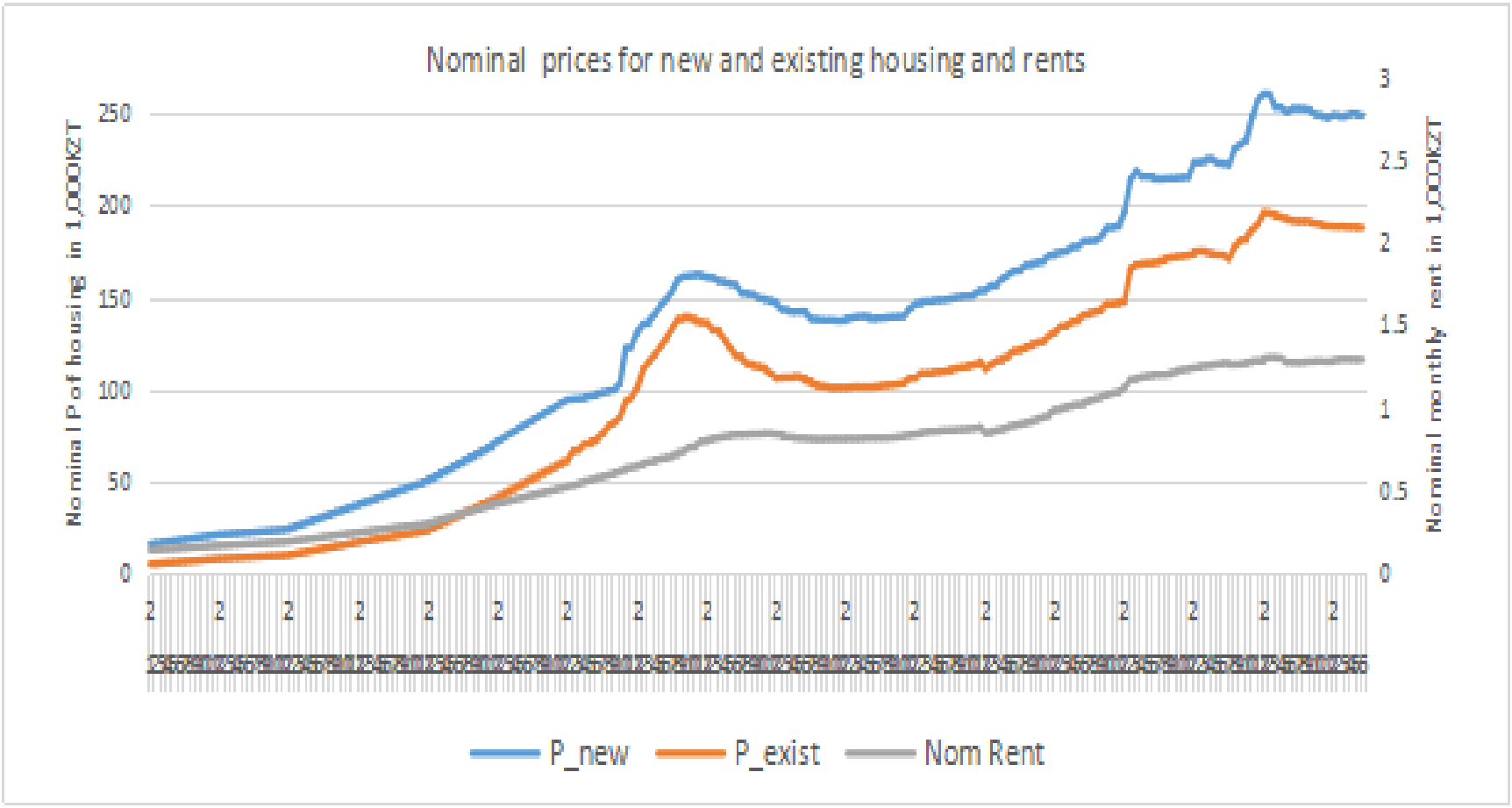
Prices, Rents, and Credit

- Average real prices for new housing increased from 13,110 KZT per sq. meter in 2000.01 (about $10/square foot) to 77,019 KZT in 2007.08 during the housing boom
  - six-fold rise in less than eight years
- Average real prices for existing housing grew from 4,108 (about $3/square foot) KZT in 2000.01 to 66,595 KZT in 2007.08
  - 16-fold increase in less than eight years
- Real rents increased “only” three times from 114 KZT to 353 KZT per sq. meter
- Real credit increased from 6.783 billion KZT to 1.219 trillion KZT
  - 500-fold increase during the boom cycle.
  - Real credit grew at 2.4% per month, nearly 33% annually.

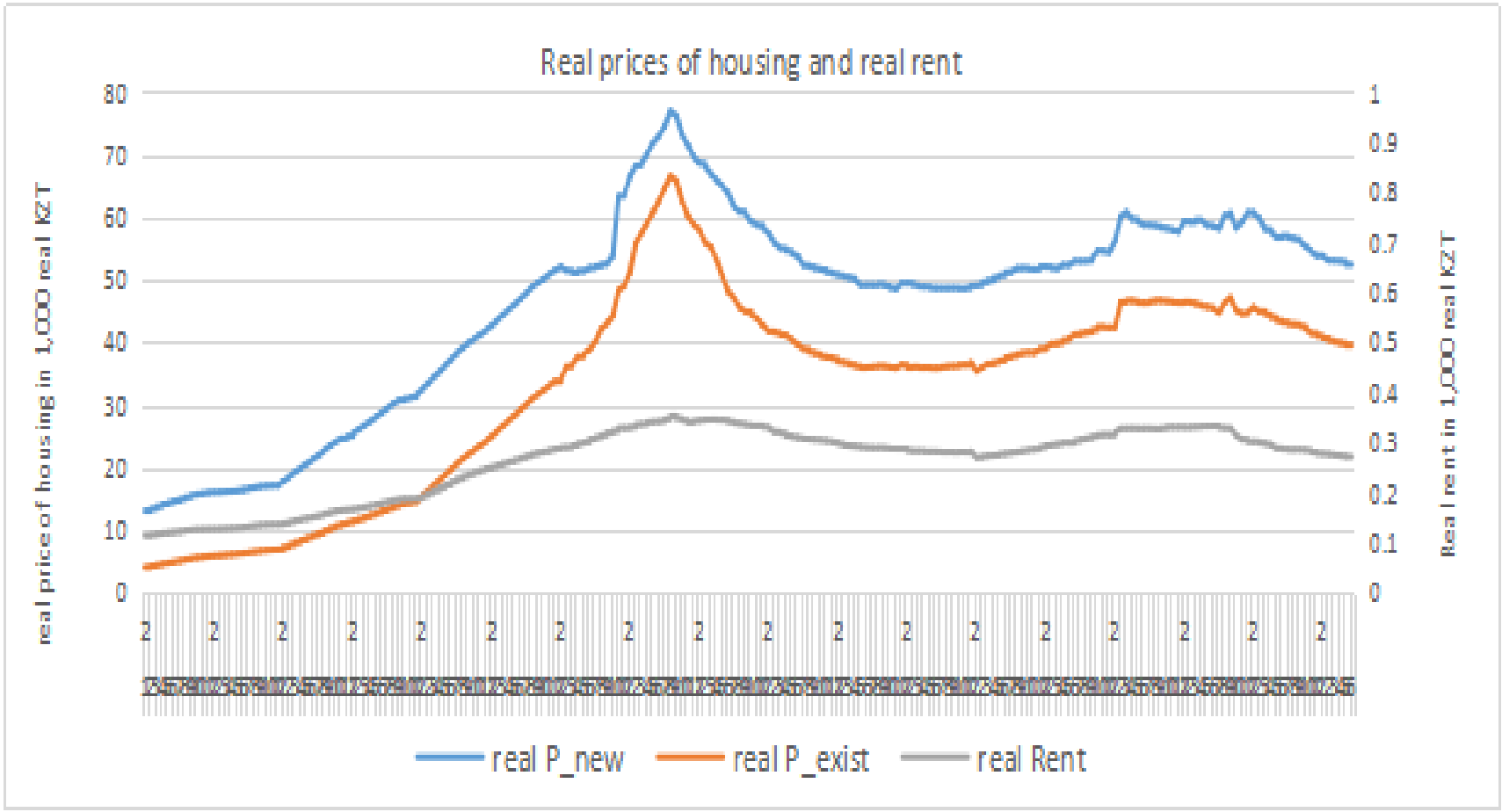
Prices vs. Average Incomes

- Approximately 6 and 18 annual average incomes were required to buy a standard apartment in an existing structure and a new apartment in January 2000.
- By July 2007 (the peak of prices), it had risen to 35 and 42, respectively, for existing and new apartments
  - Almaty apartments were the least affordable, requiring an average 48 and 44 annual incomes (earned in Almaty) to buy an existing apartment and new apartment
- Stabilized at around 18 and 23 for existing and new apartments, respectively.

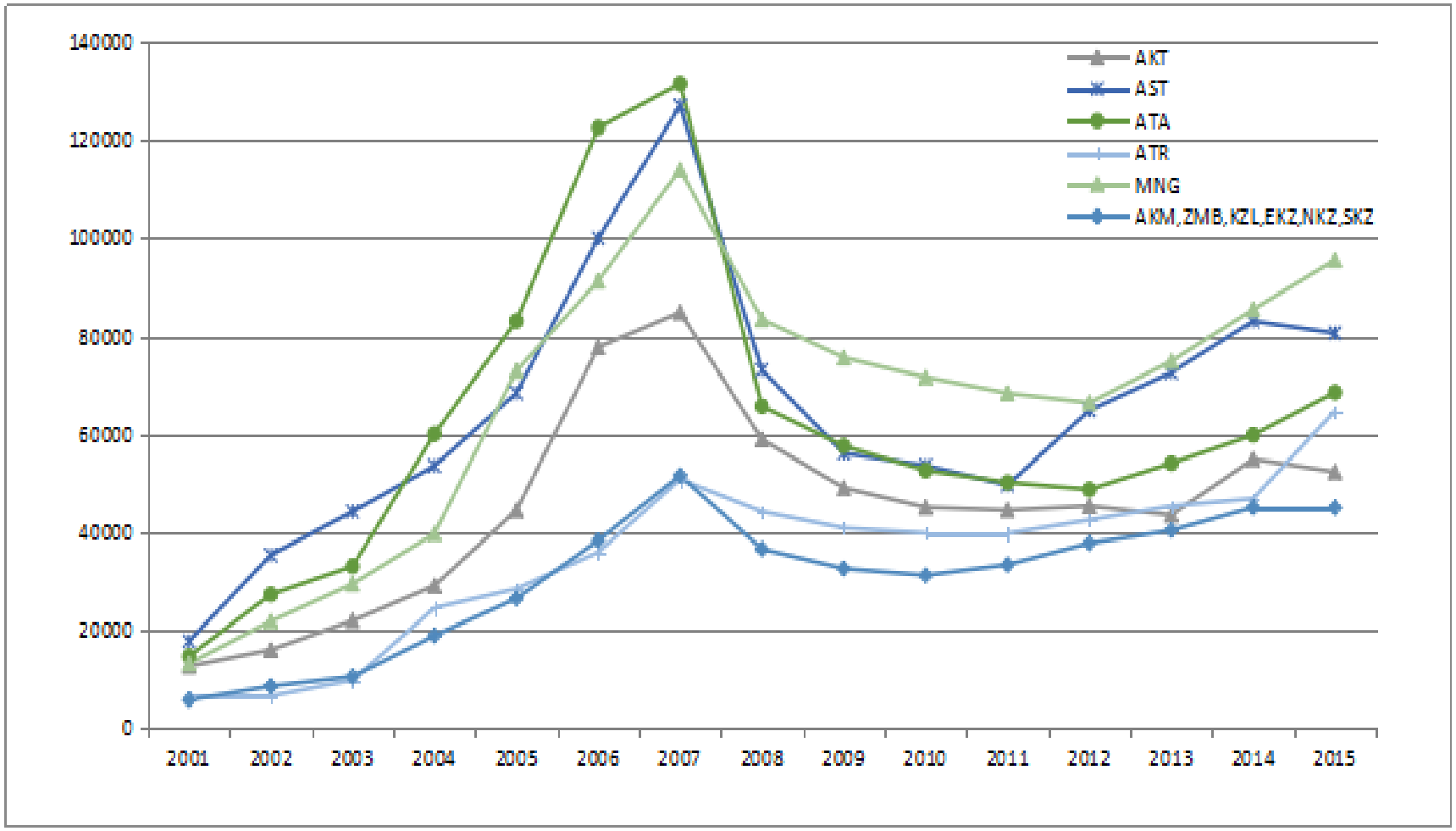
Nominal Prices and Rents



Real Prices and Rents



Regional Real Prices



II. Data

- Kazakhstan Statistical Agency
  - National Average prices for existing and newly constructed housing
    - Collected in major cities, real estate and construction companies, and advertisement information
    - Adjusted by quality, location and size
    - Monthly (2005 onward), bi-annual (2003-2004), annual (2000-2002)
    - Linearly interpolated between 2000-2004 (period corresponds to steady increase in housing prices)
  - Average Rents
  - Income
  - CPI

- National Bank of Kazakhstan
  - Credit
  - Interest Rates

- Not used here, but Ybrayev & Becker use www.krisha.kz

Description of the variables

Variable	Obs	Description of the variable
P_{New}	209	Average national price of newly constructed housing (in 1,000 KZT per 1sq.meter)
P_{Exist}	209	Average national price of existing housing (in 1,000 KZT per 1sq.meter)
Rent	209	Average national monthly rent (in 1,000 KZT per 1sq.meter)
Income	209	Average monthly income per person (in 1,000 KZT)
CPI	209	Consumer price index (=100 in 1999.01)
Credit	209	Credit extended to individuals by banks (in bln. KZT)
i_{KZT}	209	Nominal rates paid by banks on KZT denominated time deposits (%)
$i_{\$}$	209	Nominal rates paid by banks on dollar denominated time deposits (%)
r_{legal}	209	Nominal lending rates by banks to legal entities (%)
r_{indiv}	209	Nominal lending rates by banks to individuals (%)
Inflation	209	Monthly inflation (%)

III. Analysis

- Use method in Phillips *et al*. (2015) to detect and date-stamp the beginning and the end dates of explosive behavior.
- Use van Norden and Schaller (1993, 1999) rational speculative bubble model to examine whether the explosive behavior in prices was caused by rational speculative behavior caused by some extraneous factors, which caused a regime-switch in the mindset of participants.
- Using this model, we also examine whether explosive behavior could be explained by simpler fads, mixture-normal, or volatility-regime models.
- Use Froot and Obstfeld (1991) intrinsic bubbles model to determine if the explosive behavior could be explained by over-reaction to changes in fundamentals
- **We find that intrinsic bubbles do the best job explaining observed real estate price behavior, and argue that much of the shifts in fundamentals were driven by government policy.**

IV. Bubble Identification and Date-stamping

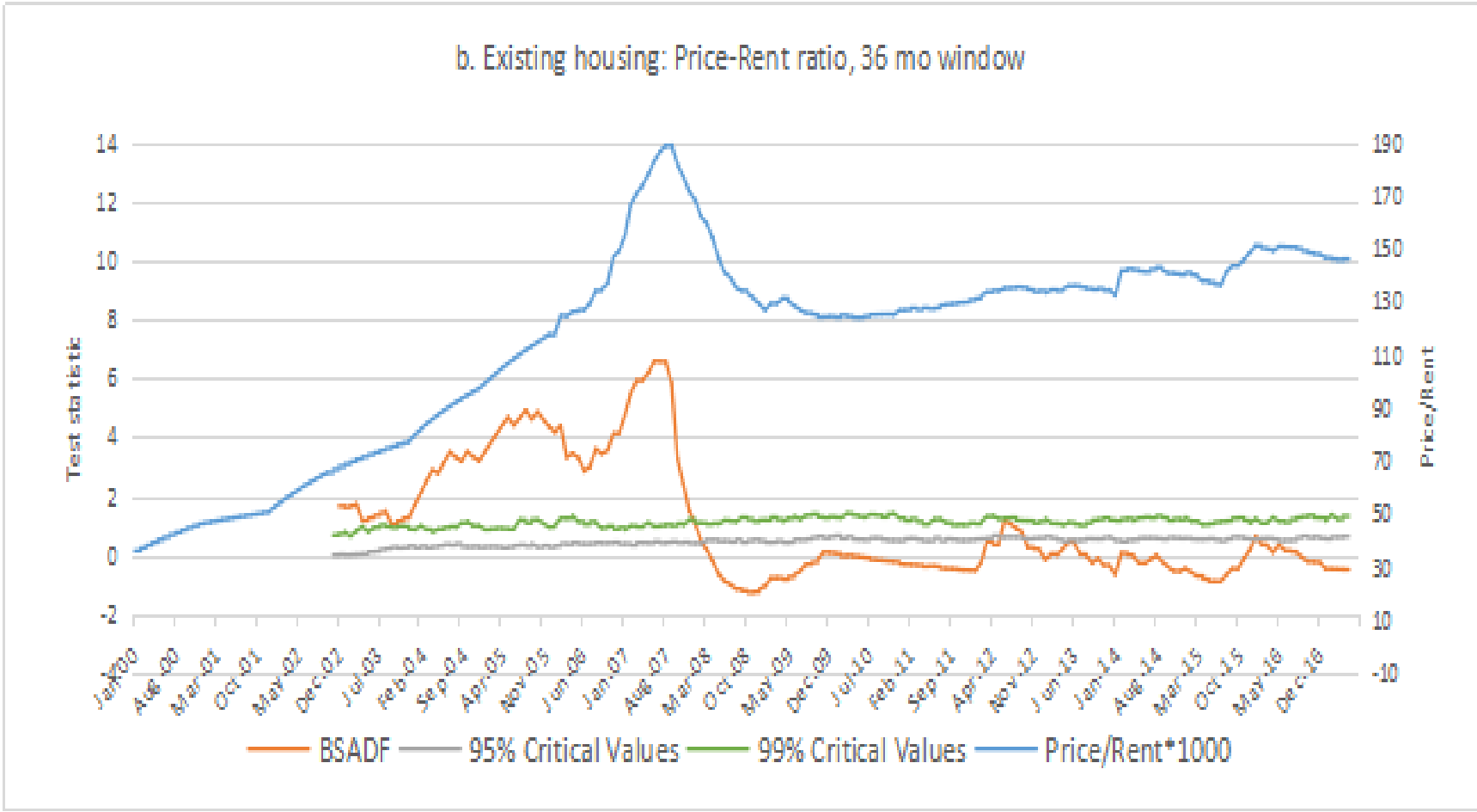
- **A bubble exists if house prices have an explosive component, while rents (a measure of fundamentals), do not.**
  - Prices integrated at higher order than dividends
- Use Augmented Dickey Fuller (ADF) right-tailed test
  - Null hypothesis of a unit root against the explosive alternative (instead of the common null of a unit root against the stationary alternative).
  - Prices and dividends should be cointegrated in the absence of a rational bubble.
  - Evans (1991) showed that such tests have low power to detect periodically collapsing bubbles because prices may look stationary and mean-reverting when bubbles collapse.

- Phillips *et al*. (2011) create a SADF (Supremum ADF) statistic based on multiple rolling window regressions to examine a possibility of a collapsing bubble.

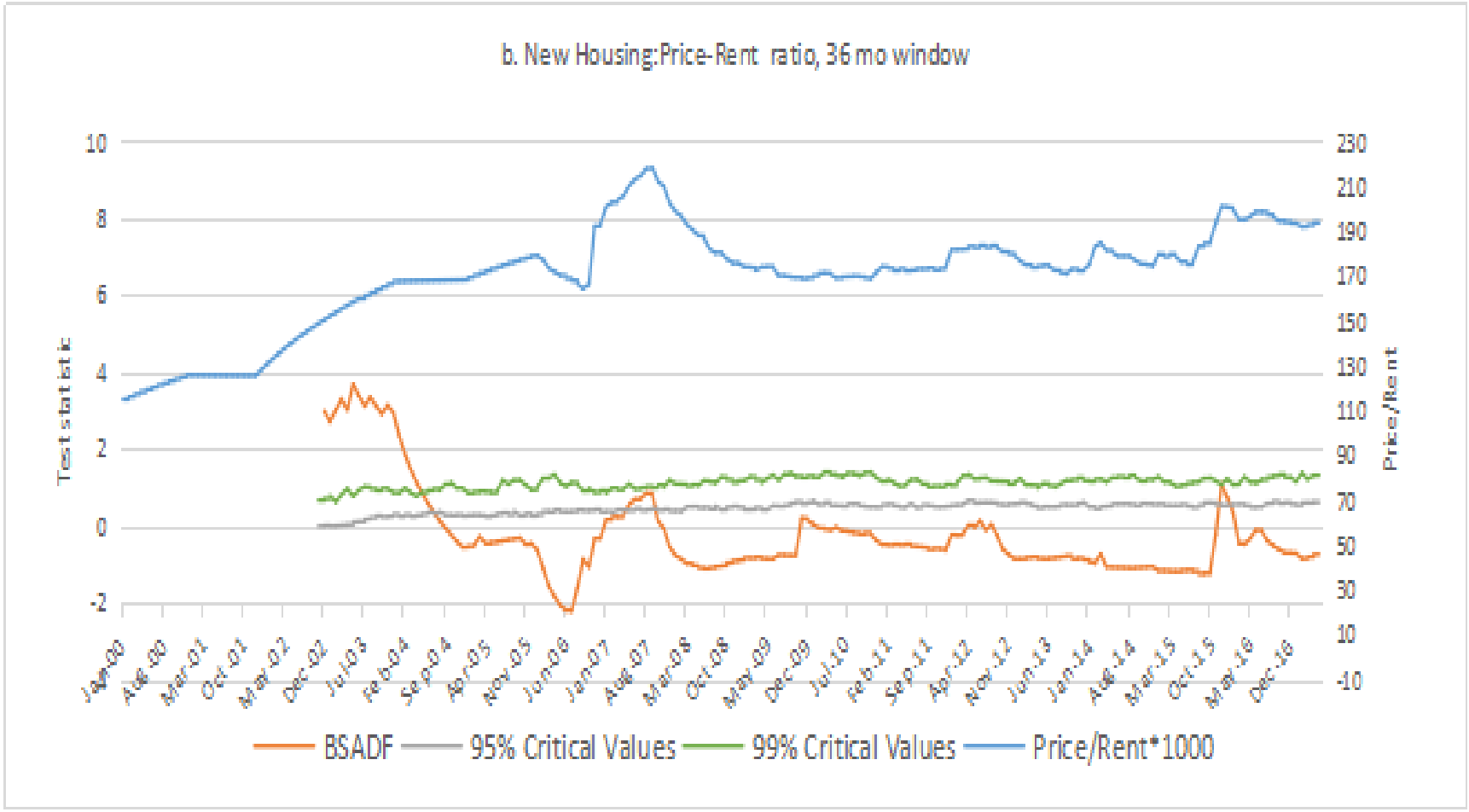
Results

- The procedure detects a bubble from 2002-2007 in the used housing market
  - Significant at the 5% significance level and robust for alternative window sizes.
  - A second, significant bubble episode is identified during 2012 using 24 and 36 month minimum windows, but not using the 48-month minimum window.
- The procedure detects a bubble from 2002-2004 in the new housing market.
  - Significant at the 1% level for all three minimum window sizes.
  - Another shorter significant episode during 2007

BSADF Test Price-Rent ratio Existing Housing (36 mo window)



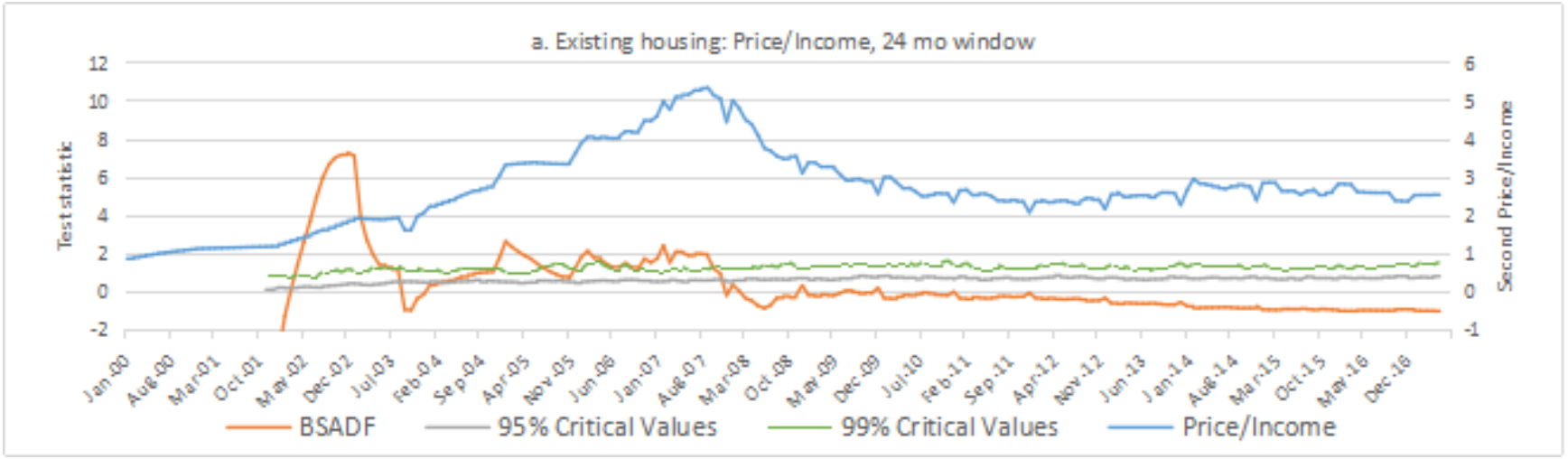
BSADF Test Price-Rent ratio New Housing (36 mo window)

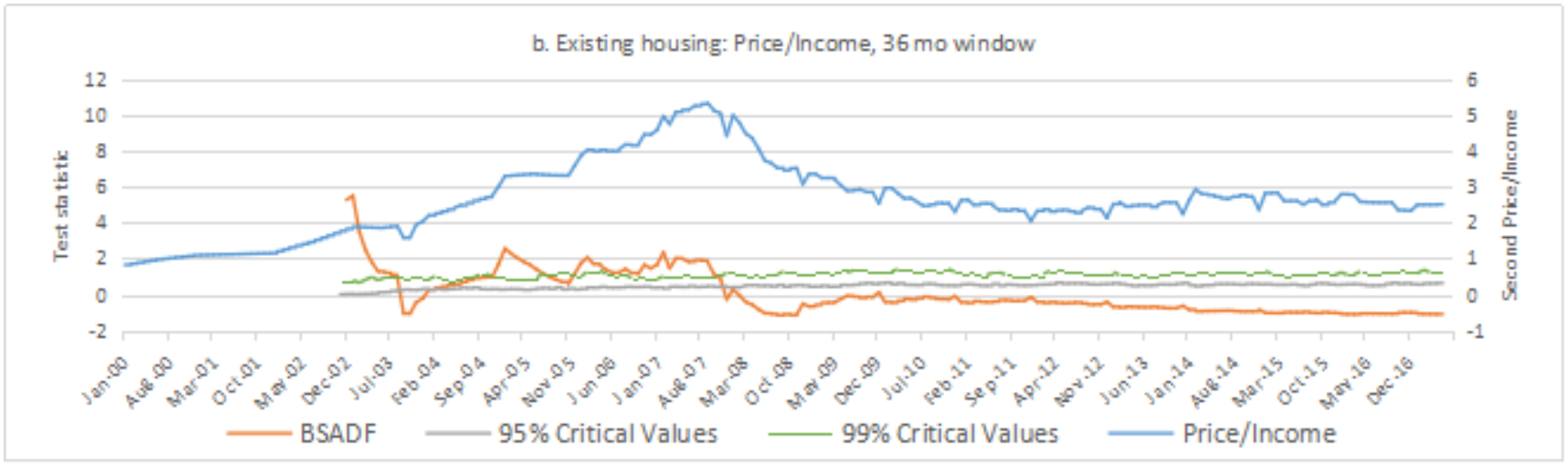


findings

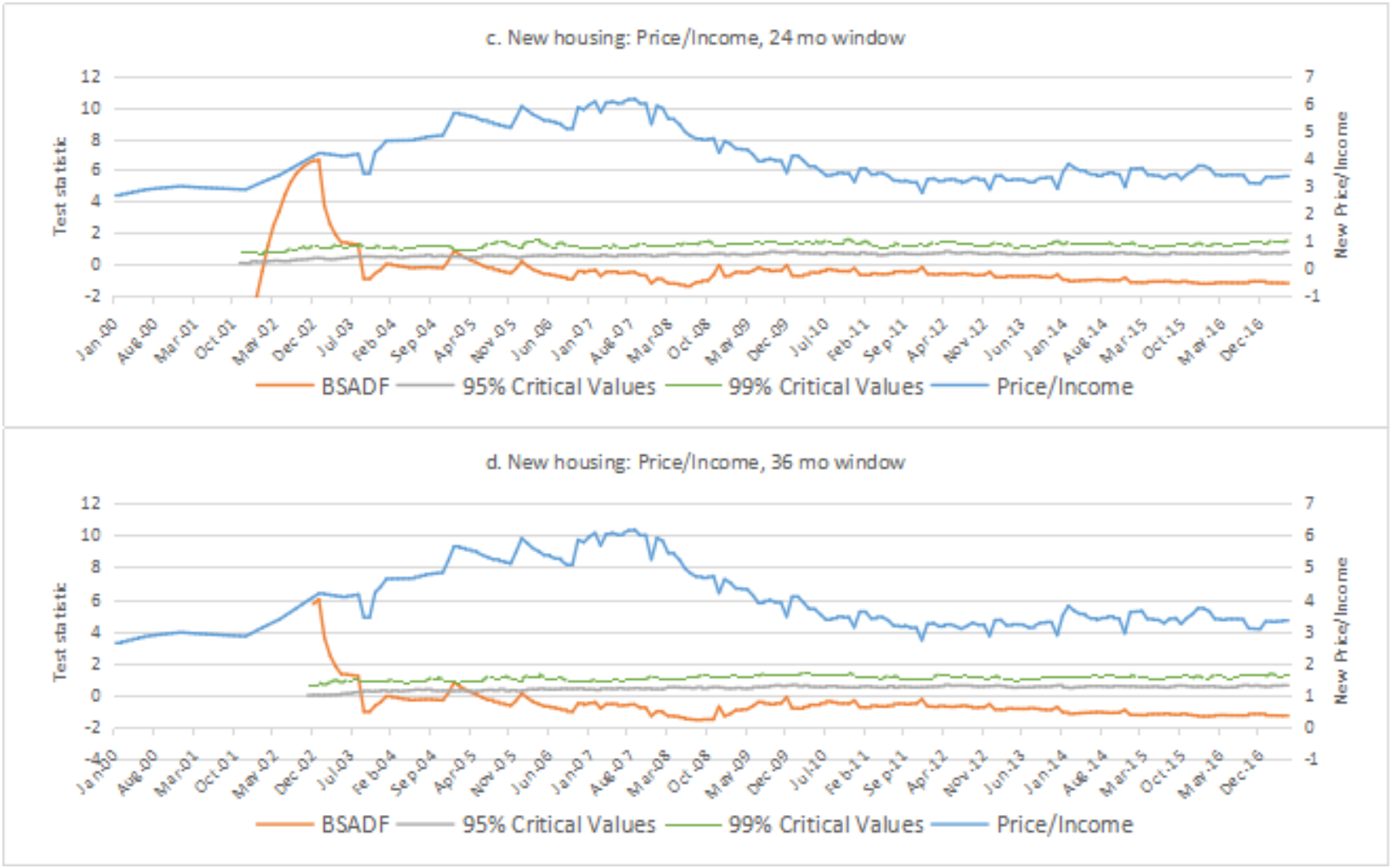
- Income is also an alternative measure of fundamentals.
- Run the same GSADF procedure for the housing price-(average per capita monthly) income ratio as a robustness check
- A bubble in existing homes is identified during 2002 – 2007
- A bubble in new homes is detected only during 2002-mid-2003 and in early part of 2005. T
- Results qualitatively similar to the results for the price-rent ratio in terms of the bubble duration in the two markets.

BSADF Test Price-Income ratio Existing Housing (24,36 mo window)





BSADF Test Price-Income ratio New Housing (24,36 mo window)



V. Rational Speculative Bubbles

- *Stochastic* or *rational speculative bubbles*
  - Blanchard and Watson (1982), van Norden and Schaller (1993, 1999), Schaller and van Norden (2002), Brooks and Katsaris (2005a, 2005b), Nneji, Brooks and Ward (2013)
- **Assumes that extraneous events, not fundamentals, create self-fulfilling beliefs of the agents in housing (financial) markets.**
- **Investors behave rationally, paying ever-higher prices for an asset during the bubble inflation because they are being compensated for the risk of holding the risky asset when the probability of collapse is non-trivial.**
- Two regimes – survival and collapse of a bubble
  - Different average returns and variances.
  - Bubbles can periodically generate and (partially) collapse.
  - Probability of regime switches depends on the magnitude of the bubble

Model

- *W* is total returns of housing (price and rental income); S = survive; C= collapse state

$$W_{S,t+1} = \beta_{S,0} + \beta_{S,1}\, b_t + u_{S,t+1}$$

$$W_{C,t+1} = \beta_{C,0} + \beta_{C,1}\, b_t + u_{C,t+1}$$

$$q(b_t) = \Phi\left(\beta_{q,0} + \beta_{q,1}|b_t|\right)$$

- Φ is standard normal cumulative distribution function for the survival regime
  - Depends on the relative size of the bubble b_t.
  - $\Phi(\beta_{q,0})$ represents the average probability of the bubble survival
  - $u_{S,t}$ and $u_{C,t}$ are mean zero *i.i.d.* normal variables.

- Calculate the bubble component using an average price to rent ratio
- Use MLE procedure to estimate

Hypothesis tests

- To test the model, we require:

1. $\beta_{S,0} \neq \beta_{c,0}$: Average returns in the two regimes should be different.
2. $\beta_{c,1} < 0$: During collapsing regime the bubble generates negative returns.
3. $\beta_{S,1} > \beta_{c1}$: The bubble contributes to higher returns in the survival regime than in the collapsing regime.
4. $\beta_{S,1} > 0$: During survival stage the bubble generates positive returns.
5. $\beta_{q,1} \leq 0$: The probability of a bubble's survival decreases with its relative size.

The Fads model

- Summers (1986), Cutler, Poterba, and Summers (1991)
- Price deviations can exist for a protracted period of time if there are fads in the stock (housing) markets
- Deviations are modeled as a stationary component in prices that decay over time and lead to mean reversion in prices

- To test the model:

1. $\beta_{s,0} = \beta_{c,0} = \beta_0$, $\beta_{s,1} = \beta_{c,1} = \beta_1$: Expected returns in both regimes should be equal
2. $\beta_1 < 0$: Returns are mean reverting
3. $\beta_{q,1} = 0$: Bubble component does not influence the probability of regime switch.

The Mixture Normal model

- Akgiray and Booth (1987, 1988)
- Returns in two regimes follow normal distributions with different means and variances.
  - Downturns usually are associated with low returns and high volatility,
  - Booms characterized by low volatility and high returns.
  - Bubble component in the model does not have any influence on returns and the probability of regime switch

- To test the model:

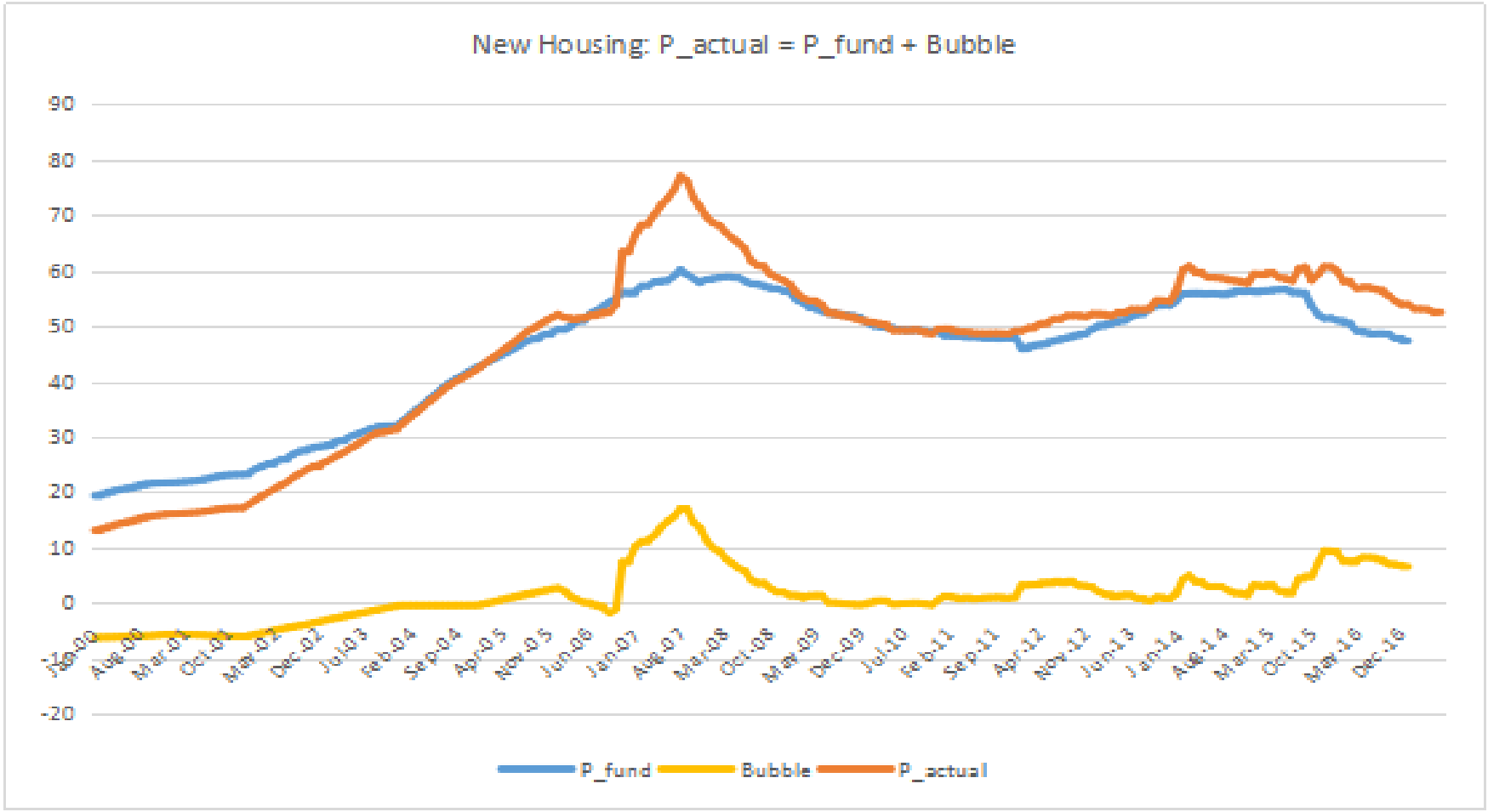
1. $\beta_{s,1} = \beta_{c,1} = \beta_{q,1} = 0$

Volatility Regime Model

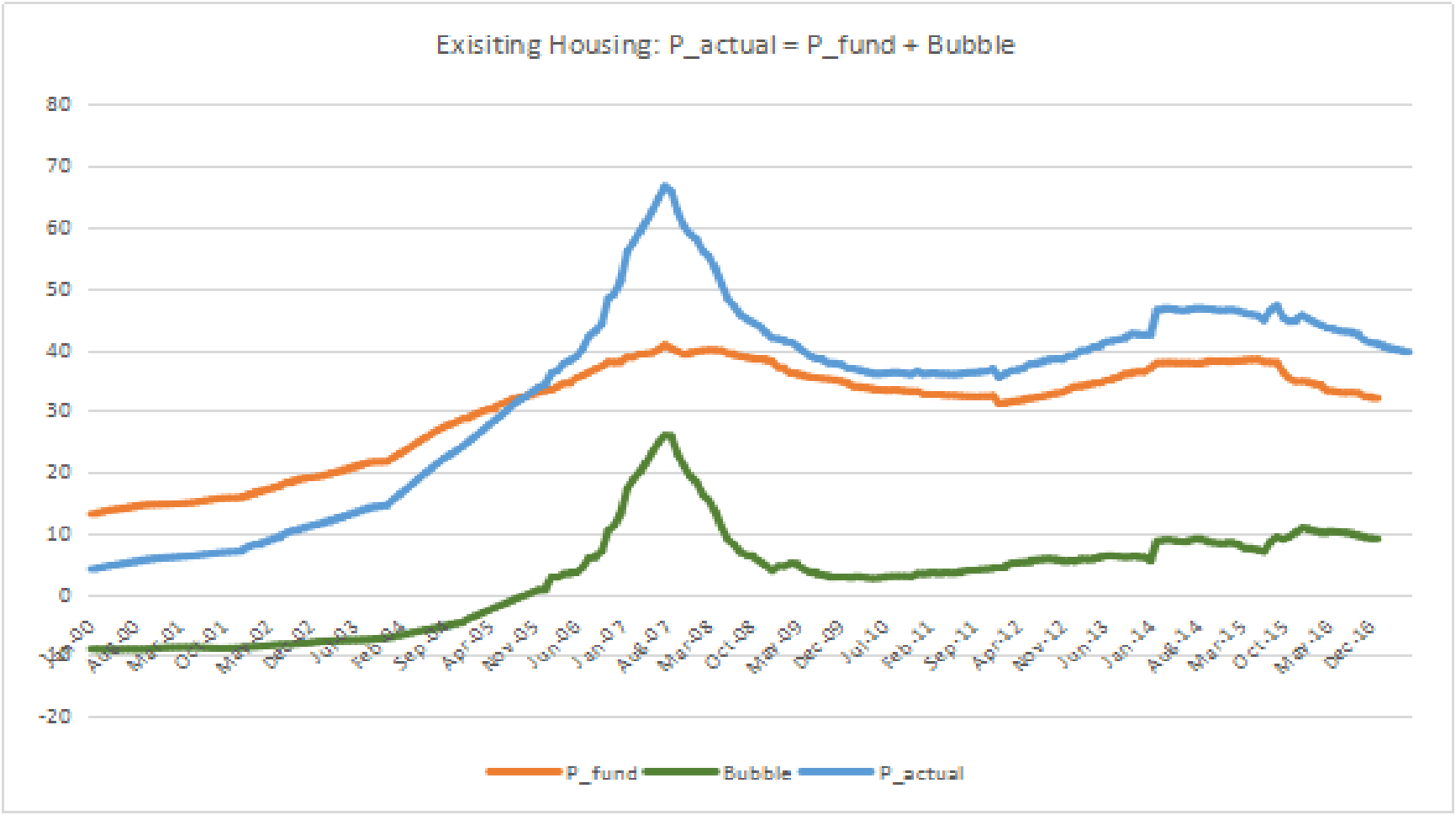
- (Schwert, 1989)
- Regimes have different volatility but same returns.
- The bubble component does not have any predictive power for either returns or the probability of being in a specific regime.
- To test the model:

1. $\beta_{s,0} = \beta_{c,0} = \beta_0, \quad \beta_{s,1} = \beta_{c,1} = \beta_{q,1} = 0$

New Housing Prices
Fundamental and Bubble components



Existing Housing Prices
Fundamental and Bubble components



Procedure and Results

- Run three specifications for the real returns on the two types of housing:
  - Without the bubble term (1 and 4)
  - With the bubble term (2 and 5),
  - With the bubble and growth of real credit variables (3 and 6).

- Specifications (1) and (4) show that the average real returns are statistically significant from zero.
  - Returns for both new and existing housing switched between two regimes – from 'high yield – high variance' to 'low yield - low variance'.
  - Returns on existing housing are higher than those on new housing during the boom period, but quite similar during the bust cycle.
    - Investors would receive a 1.73% average monthly real return on newly constructed housing and a 3.23% average monthly real return on existing housing during the boom years
    - The average real return drops to 0.25% per month during the bust period

- Specifications (2) and (5) include the bubble term.
  - Average returns are statistically significant and different in the two regimes.
    - Investors would expect to get 1.81% per month on average on new housing and 2.34% on existing housing during the boom years

Results

- Coefficients for the bubble term are statistically significant though with negative signs in both regimes
  - In both surviving and collapsing regimes, the size of the bubble has a negative impact on housing returns.
  - A one percentage point increase in the relative size of the bubble decreases monthly real returns by:
    - 0.05 percentage points on new properties and by 0.02 percentage points on existing properties during the boom cycle
    - 0.03 percentage points on new properties and 0.02 percentage points on existing properties during the bust cycle.
- Appears the relative size of the bubble did not play a crucial role for the magnitude of the returns.
- Does not correspond to the assumptions of the rational speculative bubble.

Results – Total Returns (%)

	New Housing			Existing housing		
	(1)	(2)	(3)	(4)	(5)	(6)
$\beta_{s,0}$	1.731*** (0.1418)	1.808*** (0.1718)	1.189*** (0. 3075)	3.2307*** (0.2018)	2.3375*** (0.1779)	1.2633*** (0.2653)
$\beta_{s,1}$		-0.0504*** (0.0103)	-0. 0187 (0. 0147)		-0.0289*** (0.0028)	-0.0161*** (0.0037)
Credit			0. 1812*** (0. 0666)			0.3396*** (0.0610)
$\beta_{c,0}$	0.2346*** (0.037)	0.2789*** (0.056)	0. 3377*** (0. 039)	0.2560*** (0.0803)	0.5277*** (0.0665)	0.7305*** (0.0422)
$\beta_{c,1}$		-0.0323*** (0.0030)	-0. 0120*** (0. 0037)		-0.0220*** (0.0007)	-0.0134*** (0.0008)
Credit			0. 3015*** (0. 0098)			0.4199*** (0.0102)
σ_s	1.655*** (0.0699)	1.644*** (0.0007)	2.0128*** (0. 1349)	1.9727*** (0.0897)	1.7241*** (0.0779)	1.9014*** (0.1235)
σ_c	0.2129*** (0.0196)	0.2420*** (0.03117)	0. 3098*** (0. 0261)	0.4604*** (0.0434)	0.3163*** (0.0342)	0.3131*** (0.0273)
$\beta_{q,0}$	0.4865*** (0.1025)	0.2255* (0.1376)	-.7082*** (0. 1537)	0.3388*** (0.1094)	0.3619** (0.1492)	-0.4844*** (0.1497)
$\beta_{q,1}$		0.0040 (0.0080)	0. 0261*** (0. 0089)		-0.0004 (0.0020)	0.0053** (0.0023)
Credit			0. 0191 (0. 0267)			0.0008 (0.0276)
N of Obs.	208	208	208	208	208	208

Note: Standard errors in parentheses. *** - 1%, ** - 5%, * - 10% significance level.

Results of Hypothesis tests

- We find that:
  - $\beta_{S,0} \neq \beta_{c,0}$, is satisfied in both housing markets (average real returns during the boom and bust cycles, are significantly different from each other in both new and existing housing markets)
  - $\beta_{c,1} < 0$, is satisfied (during the collapse the bubble generates negative returns)
  - $\beta_{S,1} > \beta_{c1}$ does not hold (bubble contributes to higher returns in the survival regime than in the collapsing regime).
  - $\beta_{q,1} \leq 0$ does not hold (probability of the bubble survival decreases with its relative size)

- We do not find evidence that supports the hypothesis of rational speculative behavior in Kazakhstan's real estate markets during 2000-2017.
- Formal tests of the fads, mixture-normal, and volatility-regime model also reject them.

Restriction Tests – Total Returns

	New Housing		Existing Housing	
Model restrictions (Null Hypothesis in parentheses)	Chi2	Prob > Chi2	Chi2	Prob > Chi2
$\beta_{s,0} = \beta_{c,0}$ $(H_0: \beta_{s,0} = \beta_{c,0})$	58.31	0	85.45	0
$\beta_{c,1} < 0$ $(H_0: \beta_{c,1} \geq 0)$	113.84	0	931.50	0
$\beta_{s,1} > 0$ $(H_0: \beta_{s,1} \leq 0)$	23.76	0.99	106.31	0.99
$\beta_{s,1} > \beta_{c,1}$ $(H_0: \beta_{s,1} \leq \beta_{c,1})$	2.53	.88	5.50	.99
$\beta_{q,1} < 0$ $(H_0: \beta_{q,1} \geq 0)$	0.24	.52	0.04	.42
Fads Model Restrictions: $\beta_{s,0} = \beta_{c,0} = \beta_0$, $\beta_{s,1} = \beta_{c,1} = \beta_1$ $\beta_1 < 0$, $\beta_{q,1} = 0$	570.81	0	2077.20	0
Mixture Normal Model Restrictions: $\beta_{s,1} = \beta_{c,1} = \beta_{q,1} = 0$	167.36	0	1081.57	0
Volatility Model Restrictions: $\beta_{s,0} = \beta_{c,0} = \beta_0$, $\beta_{s,1} = \beta_{c,1} = \beta_{q,1} = 0$	165.41	0	1078.65	0

Results of adding Credit

- Housing returns appear to be positively correlated to credit growth.

- A one percentage point increase in the monthly growth of real credit:
  - Increases average monthly returns by 0.18 percentage points for new housing and 0.34 percentage points on existing housing during booms
  - Increases average monthly returns by 0.30 percentage points for new housing and 0.42 percentage points on existing housing during busts.

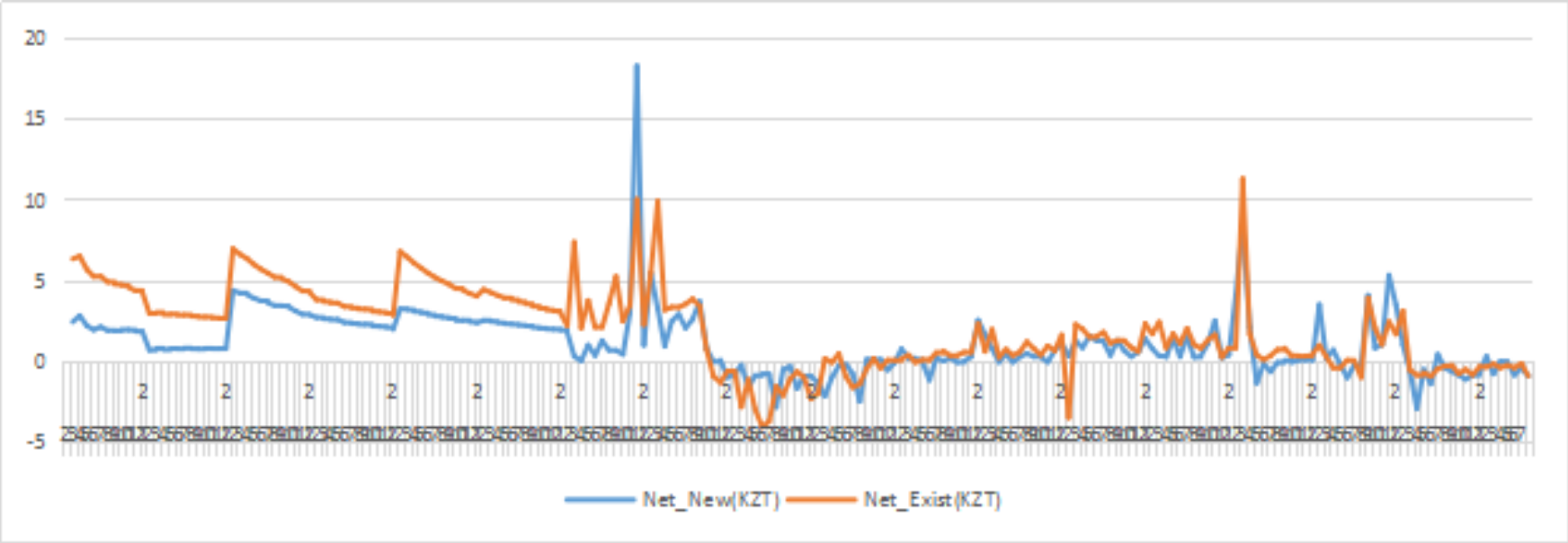
- The coefficient on the bubble term in the surviving regime is insignificant for new housing
- Probabilities are positively and significantly affected by the bubble term.
- Remaining coefficients are similar to previous specification without credit.

- There is no evidence for the rational speculative model; conditions are still not satisfied.

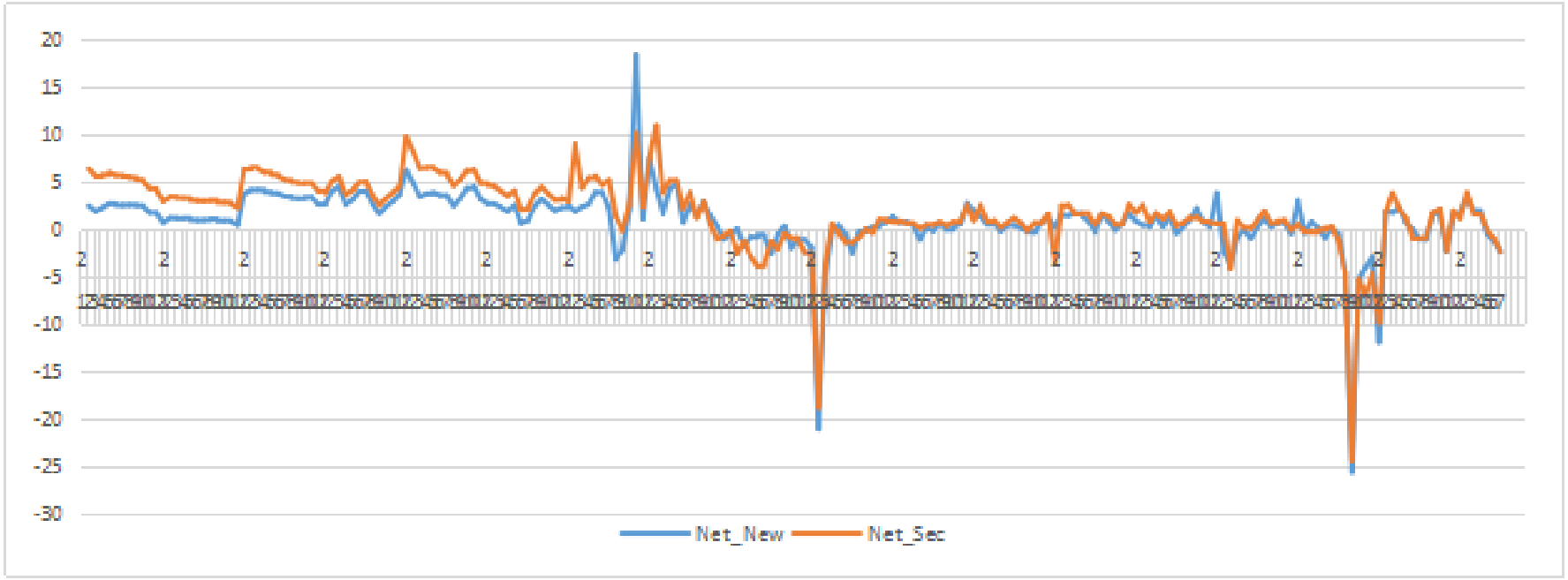
Robustness checks

- We run the same analysis on net returns using both KZT and USD denominated interest rates.
- Coefficients and significance change very little
- No evidence to support rational speculative bubble hypothesis
- No evidence for the fads, mixture-normal, or volatility-regime.

Net real returns (KZT)



Net real returns (USD)



Results – Net Returns(%) KZT

	New housing			Existing housing		
	(1)	(2)	(3)	(4)	(5)	(6)
$\beta_{s,0}$	1.4477*** (0.1273)	1.5070*** (0.1388)	0.8211*** (0.1546)	3.1944*** (0.1864)	2.1990*** (0.1709)	0.9626*** (0.1219)
$\beta_{s,1}$		-0.0346*** (0.0088)	-0.0145* (0.0084)		-0.0234*** (0.0025)	-0.0119*** (0.0022)
Credit			0.2521*** (0.0343)			0.3677*** (0.0293)
$\beta_{c,0}$	0.0899*** (0.0278)	0.1094*** (0.0347)	0.1067*** (0.0300)	-0.0102 (0.0734)	0.2520*** (0.0549)	0.0931*** (0.0182)
$\beta_{c,1}$		-0.0176*** (0.0017)	-0.0131*** (0.0016)		-0.0187*** (0.0006)	-0.0300*** (0.0002)
Credit			0.0269*** (0.0059)			-0.0798*** (0.0041)
σ_s	1.5654*** (0.0628)	1.5773*** (0.0666)	1.4495*** (0.0619)	1.7529*** (0.0849)	1.6430*** (0.0695)	1.3268*** (0.0497)
σ_c	0.1441*** (0.0169)	0.1370*** (0.0191)	0.1301*** (0.0136)	0.4772*** (0.0439)	0.2301*** (0.0331)	0.0598*** (0.0081)
$\beta_{q,0}$	0.2912*** (0.1055)	0.4712*** (0.1366)	0.3858*** (0.1407)	0.3118*** (0.1038)	0.4807*** (0.1547)	1.3800*** (0.1676)
$\beta_{q,1}$		0.0038 (0.0079)	0.0014 (0.0082)		0.0005 (0.0021)	-0.0116*** (0.0026)
Credit			0.0451* (0.0267)			0.1429*** (0.0420)

Note: Standard errors in parentheses. *** - 1%, ** - 5%, * - 10% significance level.

Restriction Tests – Net Returns KZT

	New Housing		Existing housing	
Model restrictions (Null Hypothesis in parentheses)	Chi2	Prob > Chi2	Chi2	Prob > Chi2
$\beta_{s,0} = \beta_{c,0}$ $(H_0: \beta_{s,0} = \beta_{c,0})$	92.71	0	110.26	0
$\beta_{c,1} < 0$ $(H_0: \beta_{c,1} \geq 0)$	148.87	0	903.21	0
$\beta_{s,1} > 0$ $(H_0: \beta_{s,1} \leq 0)$	15.93	.99	84.65	.99
$\beta_{s,1} > \beta_{c,1}$ $(H_0: \beta_{s,1} \leq \beta_{c,1})$	4.54	.98	3.06	.96
$\beta_{q,1} < 0$ $(H_0: \beta_{q,1} \geq 0)$	0.16	.66	0.05	.59
Fads Model Restrictions: $\beta_{s,0} = \beta_{c,0} = \beta_0$, $\beta_{s,1} = \beta_{c,1} = \beta_1$ $\beta_1 < 0$, $\beta_{q,1} = 0$	455.06	0	2005.88	0
Mixture Normal Model Restrictions: $\beta_{s,1} = \beta_{c,1} = \beta_{q,1} = 0$	169.35	0	1067.47	0
Volatility Model Restrictions: $\beta_{s,0} = \beta_{c,0} = \beta_0$, $\beta_{s,1} = \beta_{c,1} = \beta_{q,1} = 0$	169.33	0	1067.04	0

Results – Net Returns (%) USD

	New housing			Existing housing		
	(1)	(2)	(3)	(4)	(5)	(6)
$\beta_{s,0}$	1.5528*** (0.1225)	1.5946*** (0.1242)	0.2559* (0.1349)	4.7615*** (0.1618)	2.0230*** (0.1439)	0.9118*** (0.1336)
$\beta_{s,1}$		-0.0178** (0.0077)	0.0026 (0.0080)		-0.0225*** (0.0024)	-0.0105*** (0.0021)
Credit			0.3573*** (0.0311)			0.4410*** (0.0309)
$\beta_{c,0}$	-3.1120*** (0.1797)	-3.2674*** (0.4124)	-2.4152*** (0.0615)	-0.3636** (0.1641)	-3.1621*** (0.4280)	-3.6056*** (0.2561)
$\beta_{c,1}$		0.0159 (0.0553)	-0.0157** (0.0066)		-0.0152 (0.0280)	-0.0187 (0.0152)
Credit			-0.0356 (0.0355)			-0.3230*** (0.0975)
σ_s	1.5501*** (0.0603)	1.4465*** (0.0574)	1.5044*** (0.0544)	1.4740*** (0.0732)	1.7235*** (0.0668)	1.4183*** (0.0525)
σ_c	0.7074*** (0.0864)	1.0417*** (0.1147)	0.1073*** (0.0156)	1.1471*** (0.0718)	0.5153*** (0.0803)	0.3473*** (0.0481)
$\beta_{q,0}$	1.1565*** (0.1229)	0.8950*** (0.1633)	1.5789*** (0.2881)	0.2046** (0.1005)	0.8403*** (0.2053)	1.1500*** (0.2948)
$\beta_{q,1}$		0.0252* (0.0147)	0.0248 (0.0294)		0.0169* (0.0091)	0.0116 (0.0145)
Credit			0.5085*** (0.1493)			0.4231*** (0.1194)

Note: Standard errors in parentheses. *** - 1%, ** - 5%, * - 10% significance level.

Restriction Tests – Net Returns USD

	New Housing		Existing housing	
Model restrictions (Null Hypothesis in parentheses)	Chi2	Prob > Chi2	Chi2	Prob > Chi2
$\beta_{s,0} = \beta_{c,0}$ $(H_0: \beta_{s,0} = \beta_{c,0})$	136.58	0	126.66	0
$\beta_{c,1} < 0$ $(H_0: \beta_{c,1} \geq 0)$	0.08	.61	0.29	.29
$\beta_{s,1} > 0$ $(H_0: \beta_{s,1} \leq 0)$	5.34	.99	90.14	1
$\beta_{s,1} > \beta_{c,1}$ $(H_0: \beta_{s,1} \leq \beta_{c,1})$	0.38	.73	0.07	.60
$\beta_{q,1} < 0$ $(H_0: \beta_{q,1} \geq 0)$	2.95	.96	3.43	.97
Fads Model Restrictions: $\beta_{s,0} = \beta_{c,0} = \beta_0$, $\beta_{s,1} = \beta_{c,1} = \beta_1$ $\beta_1 < 0$, $\beta_{q,1} = 0$	431.83	0	1100.23	0
Mixture Normal Model Restrictions: $\beta_{s,1} = \beta_{c,1} = \beta_{q,1} = 0$	8.64	0.03	93.1	0
Volatility Model Restrictions: $\beta_{s,0} = \beta_{c,0} = \beta_0$, $\beta_{s,1} = \beta_{c,1} = \beta_{q,1} = 0$	5.69	0.06	90.28	0

Conclusion

- We reject the hypothesis of a rational speculative bubble in Kazakhstan's real estate markets during 2000-2007.
- We also fail to find support for alternative models, such as fads, mixture-normal, and volatility regime.

VI. Intrinsic Bubbles

- Froot and Obstfeld (1991)
- Persistent over- or under-valuations of prices are driven by an over-reaction to changes in fundamentals rather than by extraneous factors.
- An intrinsic bubble is a non-linear function of asset fundamentals such as rents.

- Model specification:

$$\frac{P_t}{R_t} = \kappa + cR_t^{\lambda-1} + \xi_t$$

- K and λ are model parameters determined from rents and interest rates.

Results

- We use bank lending rates to firms and to individuals to find λ.
- The coefficients and constant are highly significant for both types of housing and for both values of λ,
- Implies the existence of intrinsic bubbles in both markets.

Results – Intrinsic Bubble

Parameters	Coefficients	Coefficients
μ	0.0042*** (0.0008)	
σ	0.011289	
	λ_1 = 2.6288	λ_2 = 3.7874
C_{New}	0.0055*** (0.0002)	0.000005*** (0.0000002)
κ_{New}	120.5457*** (2.2647)	136.4023*** (1.89496)
R^2_{New}	0.7297	0.6692
C_{Exist}	0.0101*** (0.0002)	0.00001*** (0.0000003)
κ_{Exist}	23.2441*** (2.2351)	51.1998*** (1.9977)
R^2_{Exist}	0.9048	0.8670

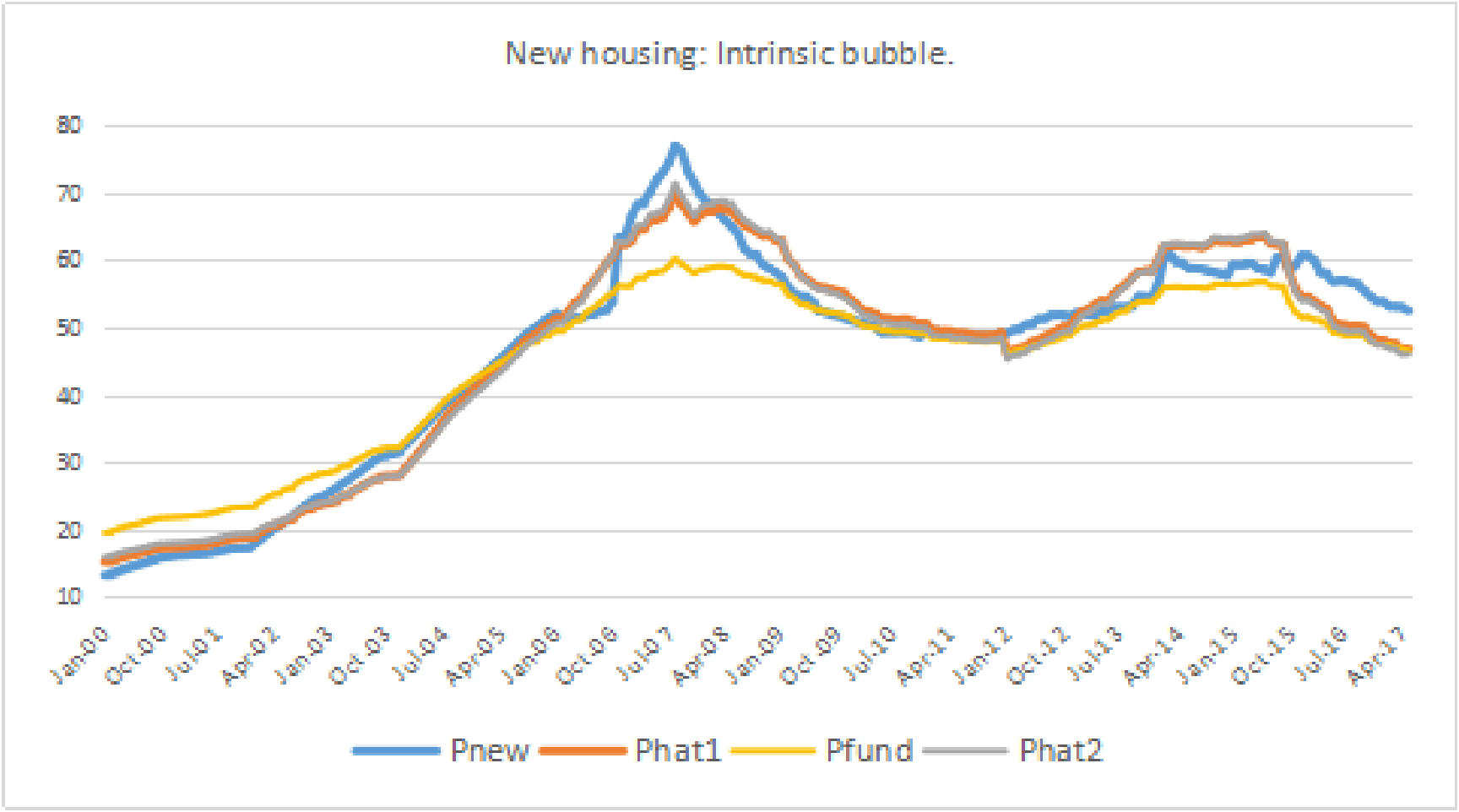
Note: $\boldsymbol{\lambda_1}$ = 2.6288 and $\boldsymbol{\lambda_2}$ = 3.7874. Standard errors in parentheses. *** - 1%, ** - 5%, * - 10% significance level.

Intrinsic Model Predictions

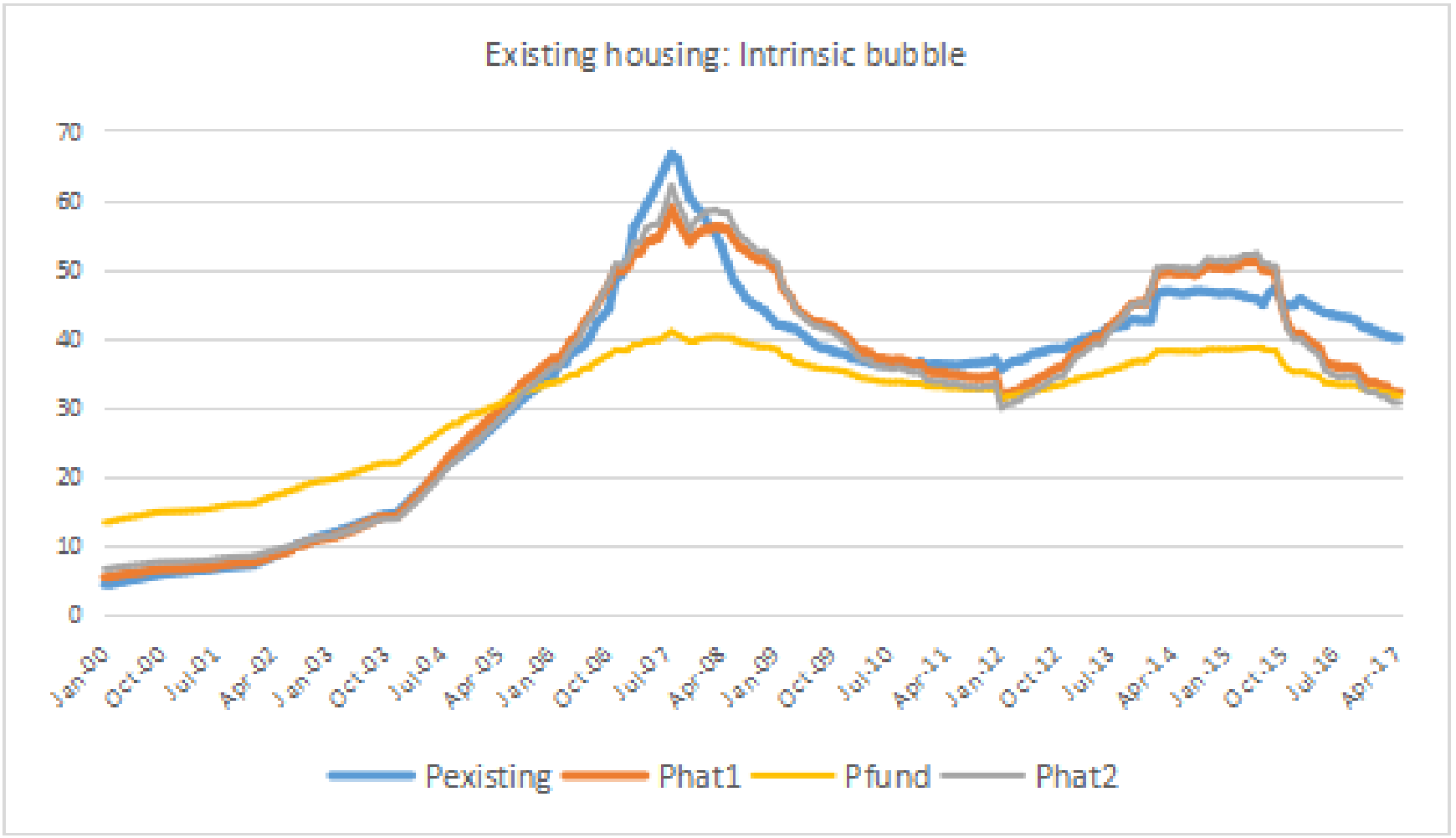
- Used the model to predict fundamental and bubble prices using λ_1 and λ_1

- We observe that:
  - Predicted prices explain actual prices better than fundamental values.
  - Predictions almost identical regardless of which value of λ is used.
  - Both types of houses were likely undervalued in the early 2000s
  - Undervaluation more large in existing housing stock.
  - There was a large bubble during 2005-2008 and another smaller bubble episode during 2015-2016 in the secondary market.

Intrinsic bubble: Actual, Predicted and Fundamental Prices. New Housing



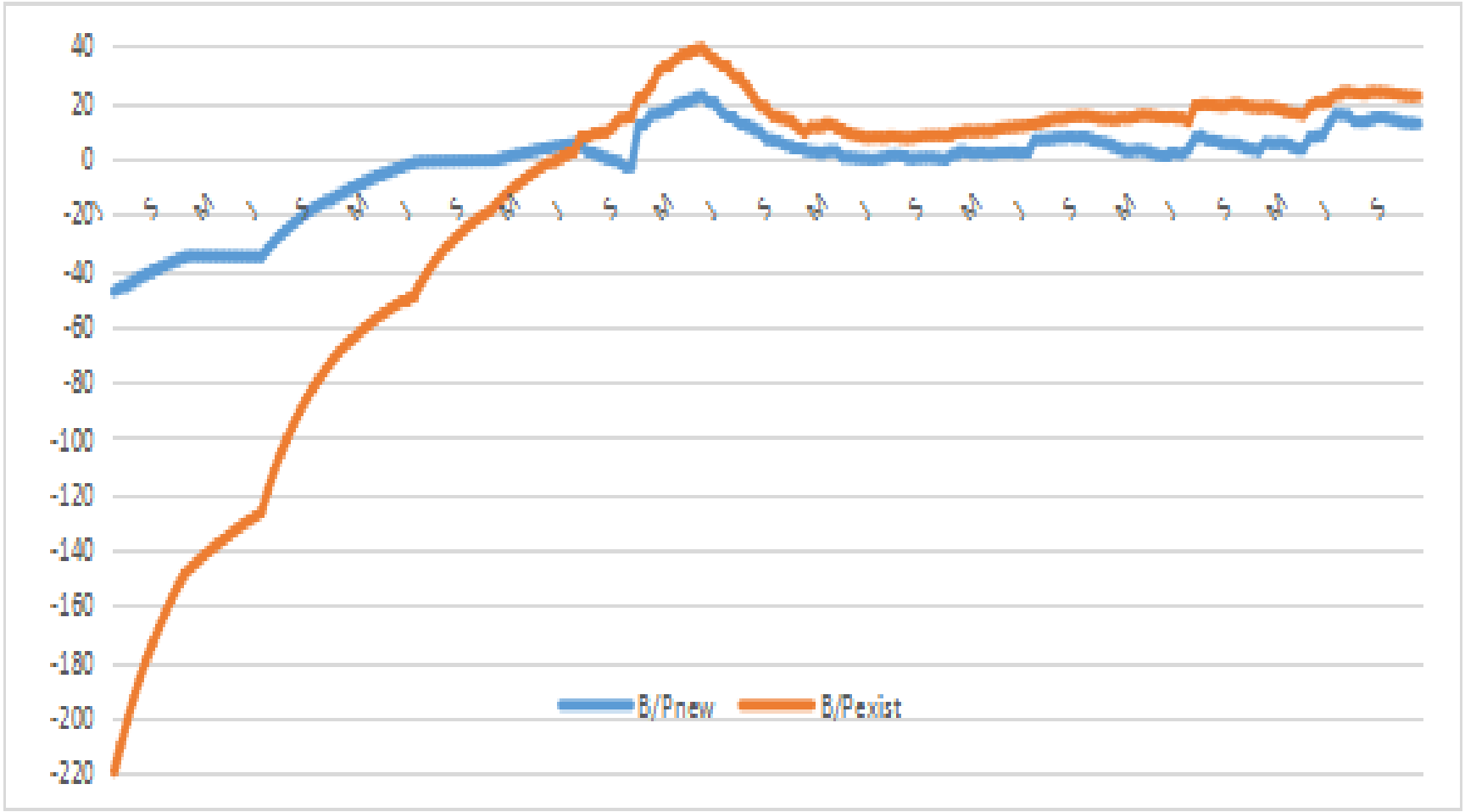
Intrinsic bubble: Actual, Predicted and Fundamental Prices. Existing Housing.



Characteristics of the bubble

- The bubble was negative from 2000 to 2004 in the market for new housing and to 2006 in the market for existing housing.
  - Housing was “undervalued”
- The bubble reached its peak in August of 2007
  - 39% of the price for existing housing
  - 22% of the price for new housing.
- By 2009 the bubble was close to 0 in the market for new housing and around 10% of the price for existing housing.

Bubble as percentage of price



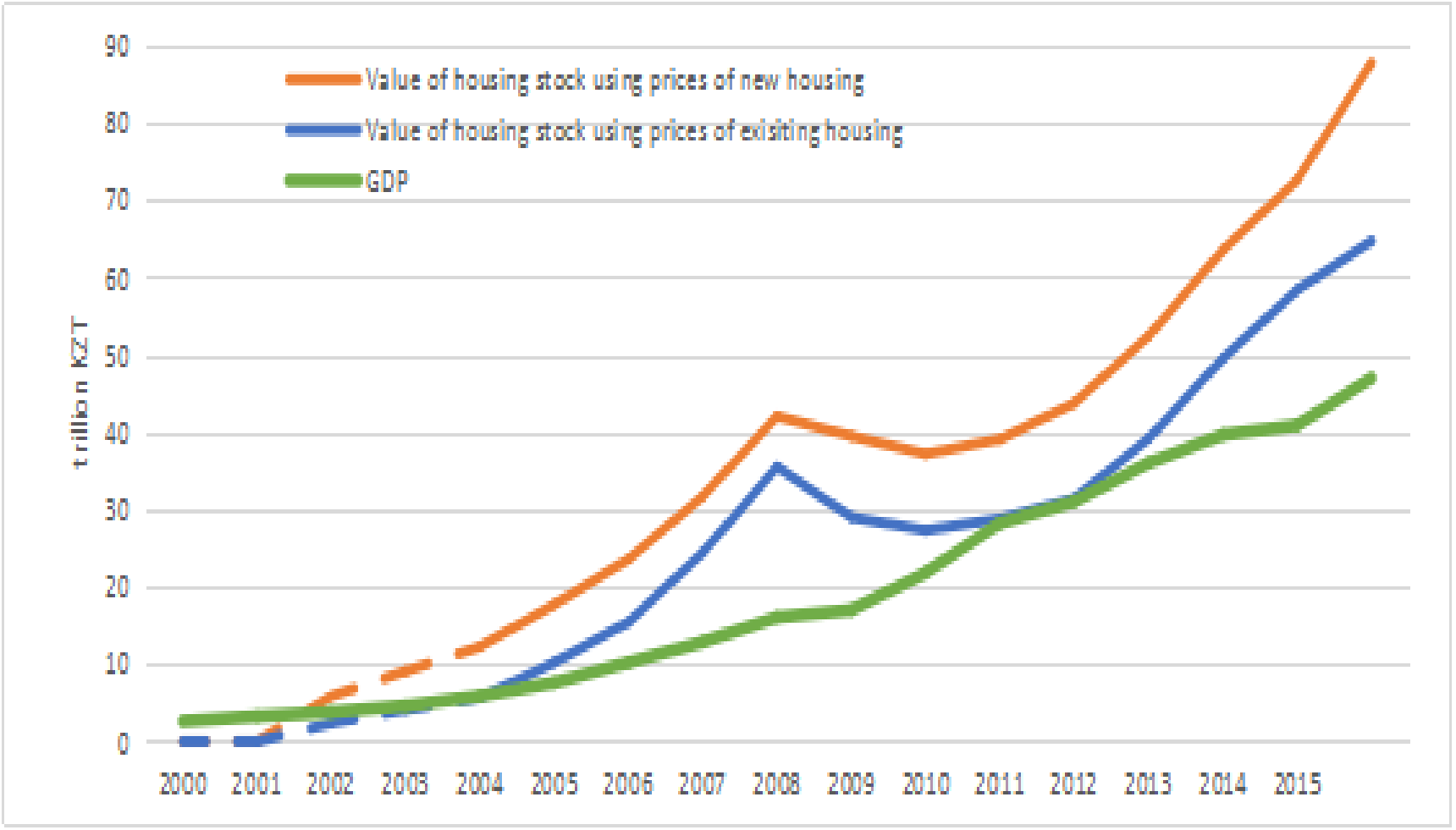
Conclusion

- Prices in the Kazakhstan real estate market during 2000-2017 can best be explained by an overreaction of real estate market participants to changes in fundamentals, rather than extraneous factors
- Intrinsic bubbles (and credit expansion) are the most plausible explanations for housing price movements.

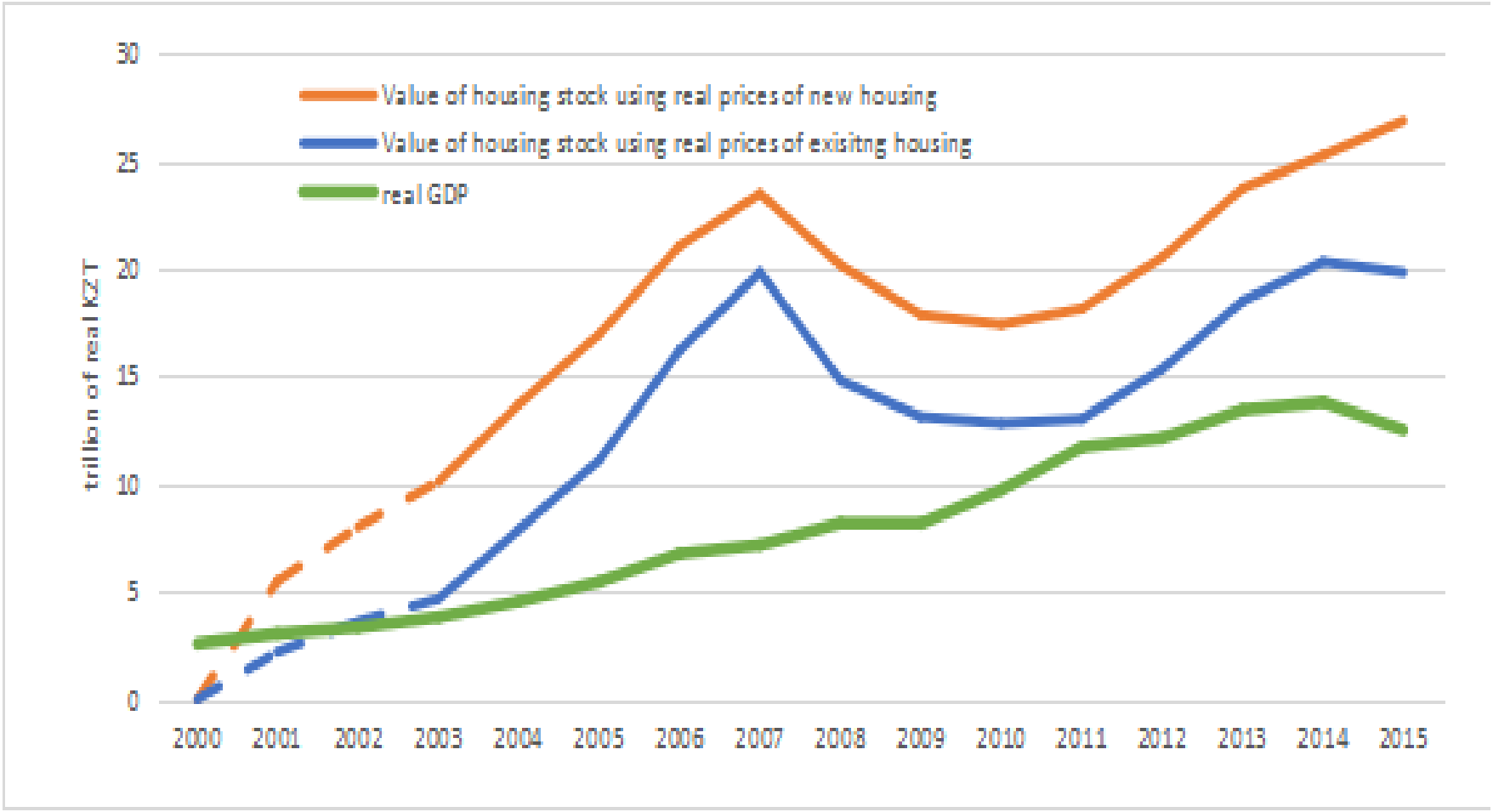
VII. Final Thoughts

- Between 2000 and 2007, the recorded real value of Kazakhstan's existing housing stock rose by a factor of roughly 13
- It likely contributed to aggregate demand
  - If the marginal propensity to consume out of housing wealth is 10%, then the implied increase in annual aggregate demand from rising real housing wealth is at least 3%.
- We estimate that the aggregate value of Kazakhstan's housing stock reached annual GDP between 2001 and 2004, and at its peak in 2007, the housing stock was 2 to 3 times GDP.
- In recent years it has settled in the range of 1.5 – 2.0 times GDP.

Estimated value of housing using nominal prices and GDP



Estimated value of housing using real prices and GDP



Previous Literature

Country/regions covered	paper	Bubbles or topic explored	Key findings
		USA	
USA	Case & Schiller (1989), (1990)	Housing price persistence	Changes in prices for single family homes in major markets during 1970-1986 are followed by subsequent changes in the same direction
USA	Schiller (2000), Schiller (2007)	Develops concept of housing asset bubbles	
USA	Abraham & Henderschott (1996)	Housing prices in 30 metro areas; growth in price divided into changes in equilibrium price and deviations from equilibrium	Some but not all regions appear to be in equilibrium at various times.
USA	McCarthy & Peach (2004)	Existence of the housing bubble in the US over the period 1977-2003	Fundamental factors such as rising income and declining mortgage interest rates can fully explain price behavior.
USA	Himmelberg et al. (2005)	Existence of the housing bubbles in 55 US MSAs during 1980-2004	Market fundamentals that are included in the cost of owner-occupied housing can reasonably explain the run-up in prices.
USA	Goodman & Thibodeau (2008)	Existence of housing bubbles in 133 metropolitan areas during 2000-2005	Only 25 out of 84 metropolitan areas experienced a property bubble (defined as house price appreciation higher than 30%) during that period
USA	Wheaton & Nechayev (2008)	Do common economic fundamentals such as employment, income, and mortgage rate sufficiently explain inflation in house prices in 59 US MSAs during 1998 – 2005.	Find a significant 'excess' in housing price inflation that is not explained by the above-mentioned market fundamentals.
USA	Mikhed & Zemcik (2009)	Investigate the unit root and cointegration properties of house prices and rents in 23 MSAs during 1978-2006.	House prices and rents are either of different order of integration or are not cointegrated, which indicates the presence of a bubble
USA	Kivedal (2013)	Cointegrating relationship between rents and house prices in the US market between 1986 and 2005.	Finds explosive behavior in house prices not explained by rents and declining interest rates.
USA	Phillips & Yu (2011)	Explosiveness in the price-rent ratio (presence of the asset bubble) in real estate, commodity, and bond markets during 1990-2009.	A real estate bubble existed between February 2002 and December 2007 and then migrated to commodity and bond markets that erupted at the end of 2008.
USA	Nneji et al., (2013)	Existence of bubbles in the US residential property market between 1960 and 2011	Rational speculative bubble during 2000-2011, but intrinsic bubble during 1960-1999.
USA	Lai & van Order (2010)	Existence of housing bubble in the US during 2000-2005 using 'dynamic Gordon growth model'.	No evidence of housing bubble during 2000-2003, but starting from 2003 formation of the bubble.
USA	Zhou and Sornette (2006)	Existence of a housing bubbles in 22 US states 1992-2005 (log-periodic power law model employed).	Evidence of a housing bubble starting from 2005 based on faster-than-exponential growth in house prices.

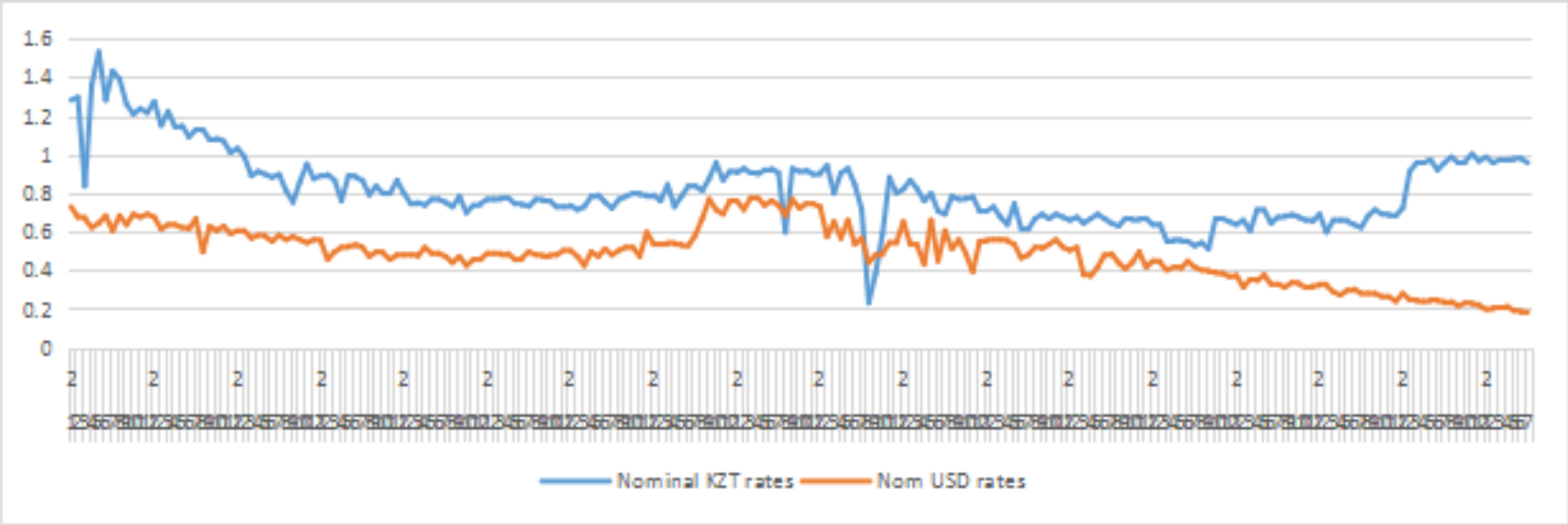
Previous Literature

OTHER HIGH INCOME COUNTRIES			
UK	Levin &Wright (1997)	Existence of housing bubble in 12 regions in UK during 1972-1994	Presence of speculative behavior in several regions during the period.
Sweden	Bjorklund and Soderberg (1999)	Existence of speculative bubbles in Sweden's real estate during 1980-1992	Find support for existence of bubbles during late 1980s.
New Zealand	Fraser et al. (2008)	Examine whether and what types of housing bubbles – intrinsic vs. rational - were present in New Zealand during 1970-2005.	Much of the overvaluation in the housing market comes from rational bubble.
UK	Black et al. (2006)	Examine whether and what types of housing bubbles – intrinsic vs. rational - were present in UK during 1973-2004.	Overvaluation in home prices in the UK was evenly split between intrinsic and rational components at the end of the sample.
Australia	Hatzvi & Otto (2008)	Examine variance decomposition of the housing price-to-rent ratio in 36 Local Government Areas in Sydney, Australia, during 1991-2006	In outer western suburbs of Sydney 60% of variation in price-rent series was not explained by the fundamentals, while in locations close to Sydney, it was fully accounted by fundamentals.
18 OECD countries	Engsted et al. (2016)	Existence of explosive behavior in housing markets of 18 OECD countries during 1979-2013.	Find supporting evidence for existence of bubbles in 16 countries
22 mostly OECD countries	Pavlidis et al. (2016)	Existence of explosive behavior and synchronization in housing markets of 22 mostly OECD countries during 1975-2013.	Find evidence of explosive behavior from 2000 up to the global financial crisis of 2008-2009. Confirm simultaneity in pricing behavior across those countries.
Israel	Caspi (2016)	Existence of housing bubbles in Israel on national and regional levels during 1999-2013.	No evidence of housing bubbles.
UK and Singapore	Giglio et al. (2016)	Evidence of housing bubbles in UK and Singapore during 1995-2013.	No evidence of housing bubbles.
Ireland	Roche (2001)	Existence of speculative bubbles or fad sin Dublin, Ireland, during 1976-1999.	Evidence for existence of a speculative bubble in Dublin's house prices.

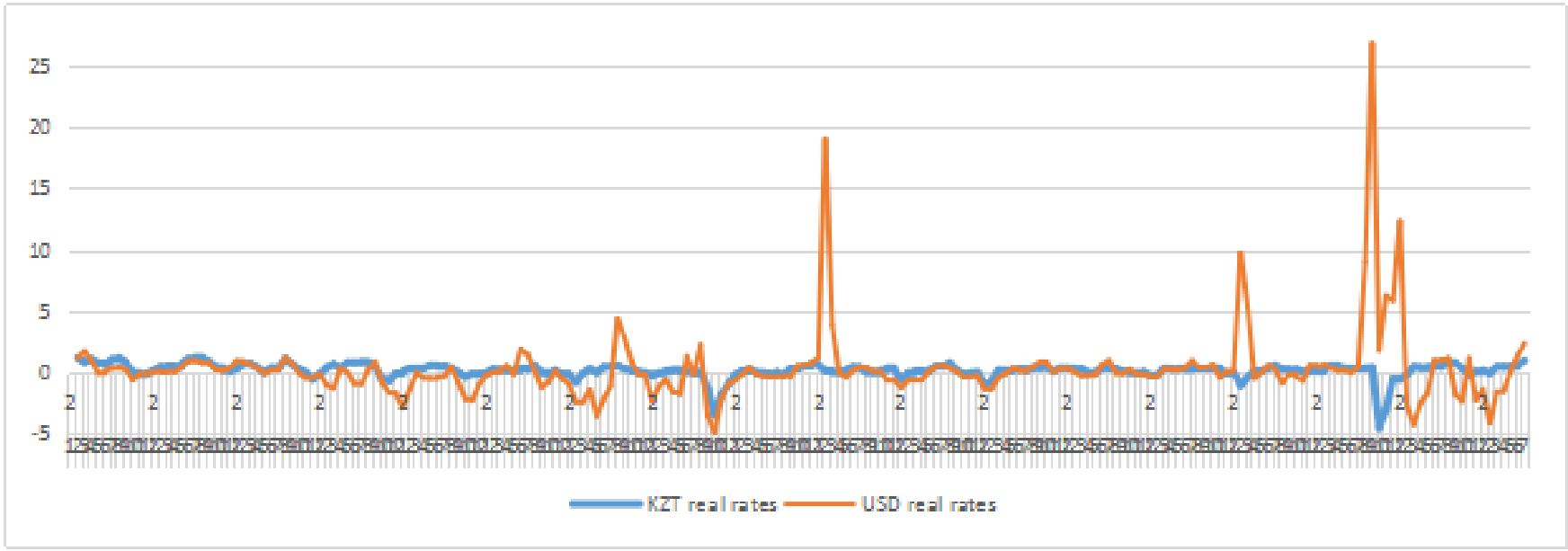
Previous Literature

DEVELOPING COUNTRIES			
China	Ren et al. (2012)	Existence of rational expectation bubbles in 35 Chinese cities during 1998-2008	No evidence of housing bubbles.
China	Dreger & Zhang (2013)	Existence of rational expectation bubbles in 35 Chinese cities in 2008-2009	Overvaluation in housing prices in Shanghai, Beijing, special economic zones and southern coastal cities.
China	Lai & Order (2016)	Relationship between property values and shadow banking in 65 Chinese cities during 2007-2014	Prices grow faster with the availability of shadow banking, but no evidence of housing bubbles.
China	Hui & Yue (2006)	Existence of housing bubbles in Beijing, Shanghai and Hong Kong during 1997-2003	Shanghai experienced a bubble in 2003, while Beijing did not. Hong Kong had a pronounced bubble in the 1990s prior to the Asian financial crisis
China	Ahuja et al. (2010)	Alignment of property values with the long-run equilibrium in 35 Chinese cities during 2000 – 2009.	Evidence of overvaluation in Beijing, Shanghai and some inland cities. Mass market housing in Shanghai and Shenzhen and the high-end market in Beijing and Nanjing were overvalued.
South Korea	Kim & Lee (2000).	Presence of real estate bubble in Korean housing market during 1974-99.	No evidence of bubbles.
Colombia	Gómez-González et al. (2015).	Evidence of housing bubbles in Bogota, Colombia, during 1994-2013	Evidence of a bubble in the second half of 2012 in the medium and high segments of the housing market
Chile, Colombia, Mexico, Peru	Cubed et al. (2012)	Existence of bubbles in Chile (2004-2011), Colombia (2001-2011), Mexico (2005-2011), and Peru (1998-2011)	Except for Colombia, these countries did not experience housing bubbles during the sample periods.
Poland	Leszczynski & Olszewski (2014)	Main determinants of house prices in the 17 cities in Poland during 2002-2013	Lagged price has a positive impact on the current price, which indicates the herding behavior.
Russia	Drobyshevskii et al. (2009)	Presence of real estate bubbles in 62 Russian regions during 2002-2006.	Speculative factors contributed 30% to the housing price increase.
Russia	Alekseev et al. (2013)	Existence of bubbles in residential market in Irkutsk (Russia) during 2012.	Evidence of a small bubble.
Kazakhstan	Mynbaev & Ibrayeva (2011)	Main house price determinants in Almaty, Kazakhstan, during 2004-2009	indication of a housing bubble based on increasing size of time dummies.

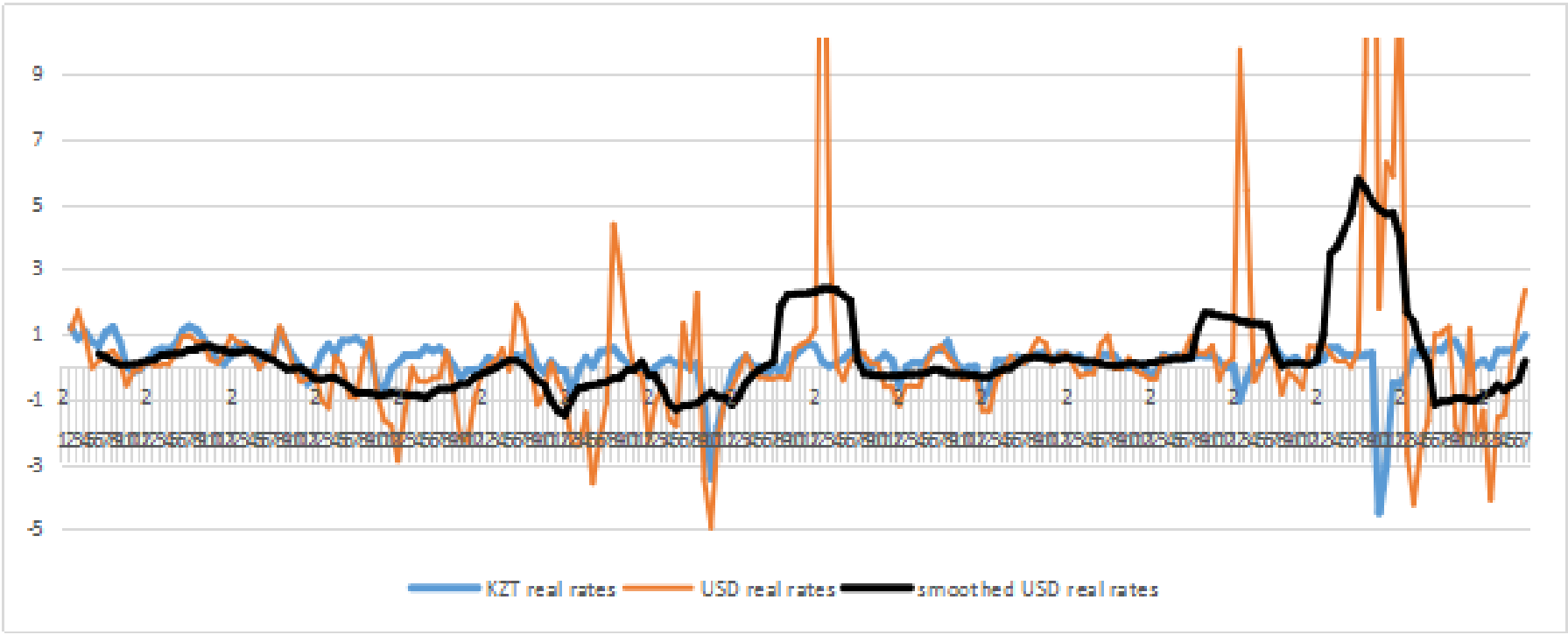
Monthly nominal interest rates



Monthly Real Deposit Rates



12 mo. Moving Average USD denominated time deposits



Net real returns USD
(12 mo. moving average)