Assessing House Prices:

Simple Valuation and Prudential Measures

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Czech National Bank Seminar,
July 10, 2018 Prague

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House Prices

Questions Asked:

- Are the Czech and Prague house prices **overvalued?**

- What are '**fair values**' given by the fundamentals?
- How much housing can households **safely borrow** for?

- How do fundamental valuations compare to market prices?

House Prices

Questions Answered:

- Our indicators suggest that on average house prices are **overvalued** with respect to fundamentals
- Our indicators suggest **house prices should be growing**, due to increase in disposable income and low interest rates...

How Do We Assess House Prices?

Houses are durable **assets**. And people **borrow** to buy it. . .

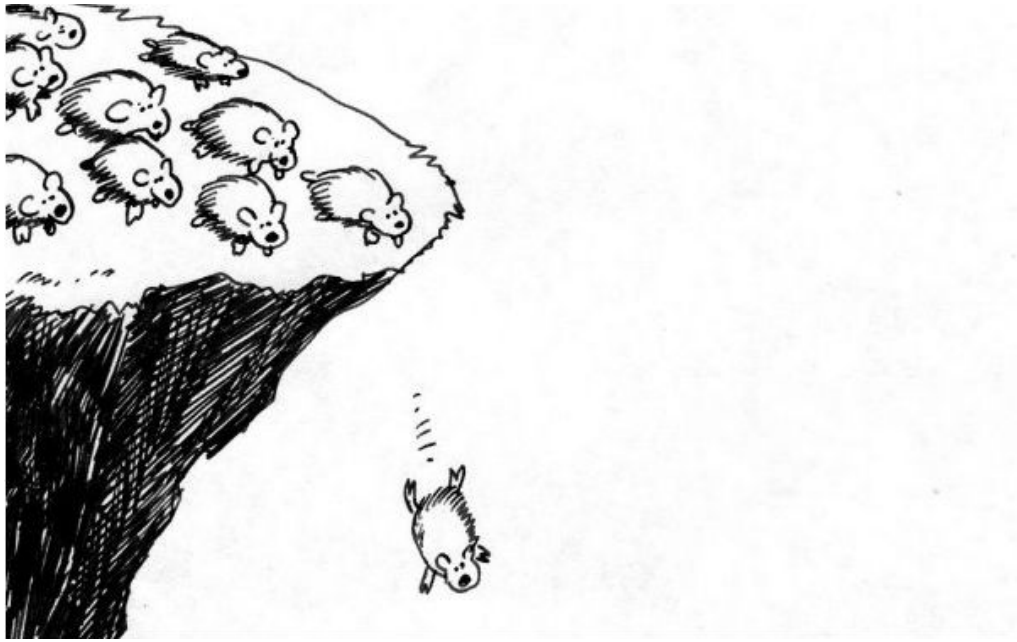
- **Intrinsic/Fair Value**
  - + Expected present value of net rental income.
  - + Should you rent or buy?

- **Borrowing Capacity**
  - + How much can the household safely borrow?
  - + How much housing can they afford?

$$\text{borrowing capacity} \neq \text{fair value}$$

Value of Valuation

- Valuation provides a way to find an **intrinsic value** of an asset and compare it to the market price. . .
- Valuation is **simple**, we choose to make it complex
  A. Damodaran



DON'T
BE
A
LEMMING

Valuation is a Process

- **We provide a flexible framework, not just numbers**
- Thinking hard about parameters and assumptions entering valuation is crucial (and fun)
- So, YES, valuation is inherently subjective...
  ...but transparently so
- Valuation is simple but not easy...(Ch. Munger)

Approach Taken

- **We use theory directly to obtain valuation measures**, not to motivate regression equations. . .
- **We take units of measurement seriously**
  Working with prices, not just price indexes is essential
- **We explain housing value and its dynamics**
  It's about levels, not just about house prices growth!!
- **We do not use an ad-hoc regression model**
  but create simple and flexible indicators and models

Approach **Not Taken**

1. **Most of the literature** uses etimated **time-series models** to explain house prices indices

2. Also popular is to compare normalized price/rent or price/income **multiples** with history, etc.

3. Occasionaly, a **static** versions of steady-state arbitrage formulas are used (a la Gordon model). E.g. $P_t = rent_t / \text{`}usercost\text{'}$

4. ...

ON HOUSE PRICES REGRESSIONS...

And why we do not use them

House Prices Regressions: Typical Example

Most of the time, the models are either growth or level regressions:

OLS:

$$\dot{p}_t = \alpha_0 + \alpha_1 \dot{w}_t + \alpha_2 \dot{i}_t + \alpha_3 \dot{crdt}_t + \alpha_n \dot{x}_t + \varepsilon_t$$

or

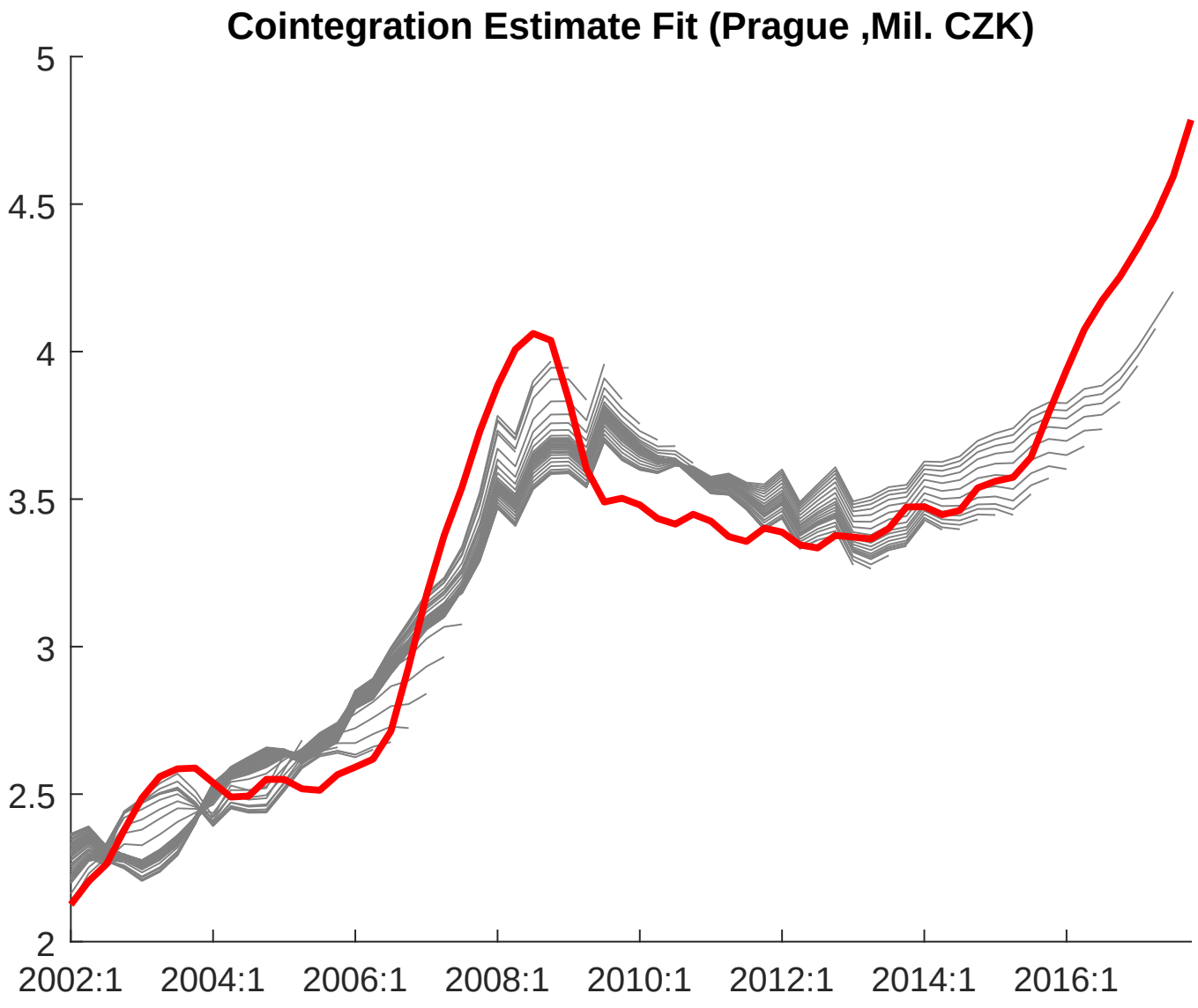
ECMs: (Error-Correction Models)

$$\begin{aligned} \dot{p}_t &= \alpha_0 + \alpha_1 \dot{w}_t + \alpha_2 \dot{i}_t + \alpha_3 \dot{crdt}_t + \alpha_n \dot{x}_t - \gamma EC_{t-1} + \varepsilon_t \\ EC_t &\equiv p_t - (\beta_0 + \beta_1 w_t + \beta_2 i_t + \beta_3 crdt_t + \beta_n x_t) \end{aligned}$$

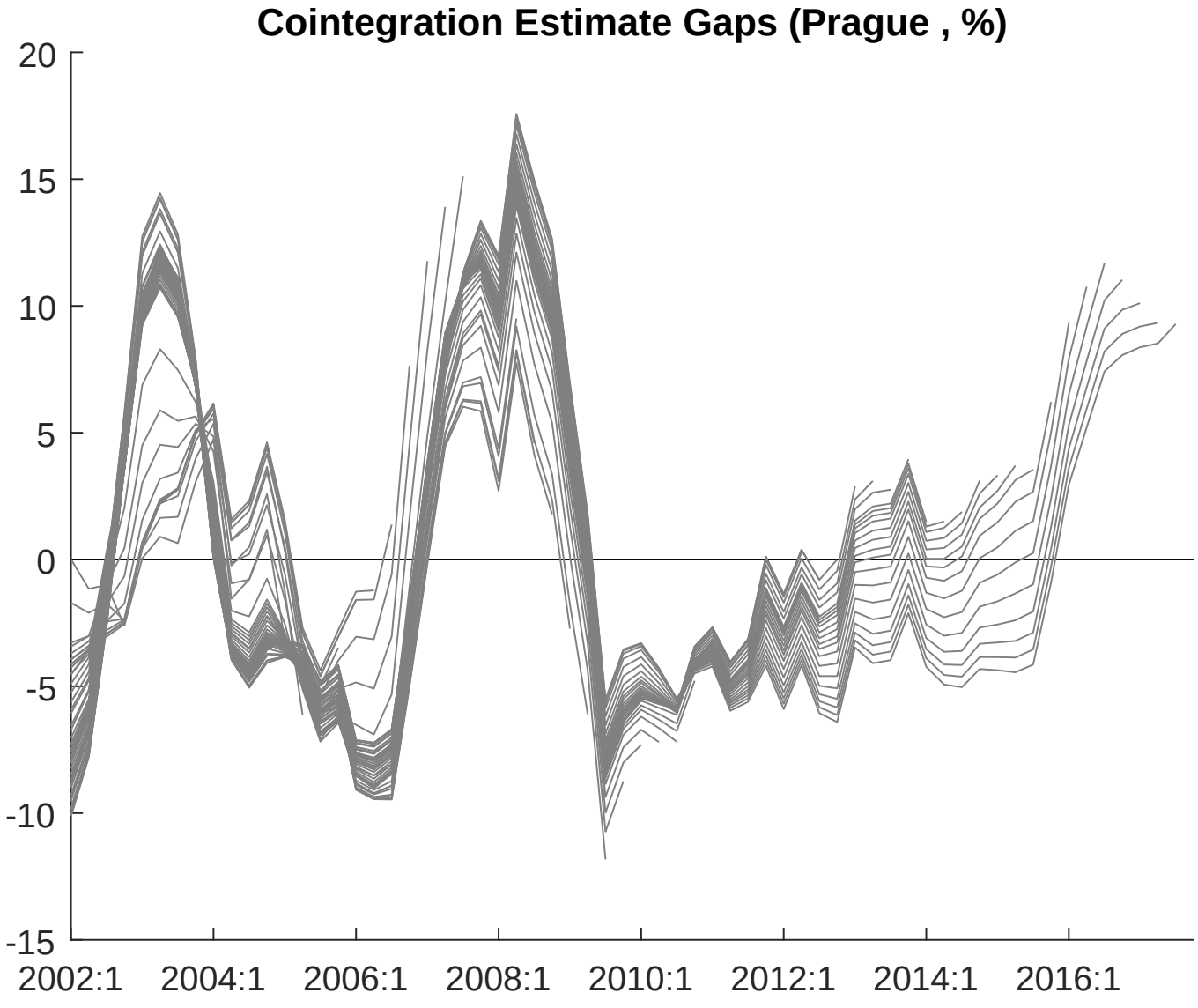
House Prices Regressions

- Vaguely motivated by economic theory, often without any theory restrictions, **backward-looking**...
- Econometric **models require a lot of data** for estimation, preferrably over multiple housing and/or business cycles
- The parameters are not structural and possibly unstable
- Often over-parameterized / over-fitted...
- Often, the co-integrating model fit is considered as 'equilibrium';
- Difficult to handle over-valuation-only data [**zero-mean residuals**]

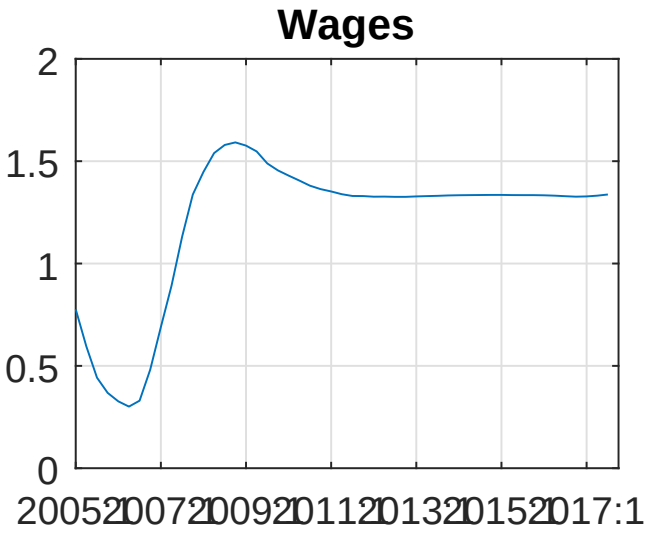
House Prices Regressions: Toy Example

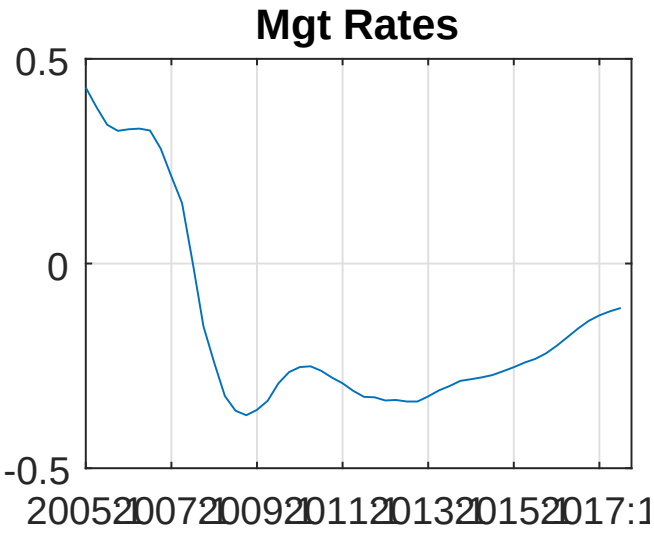


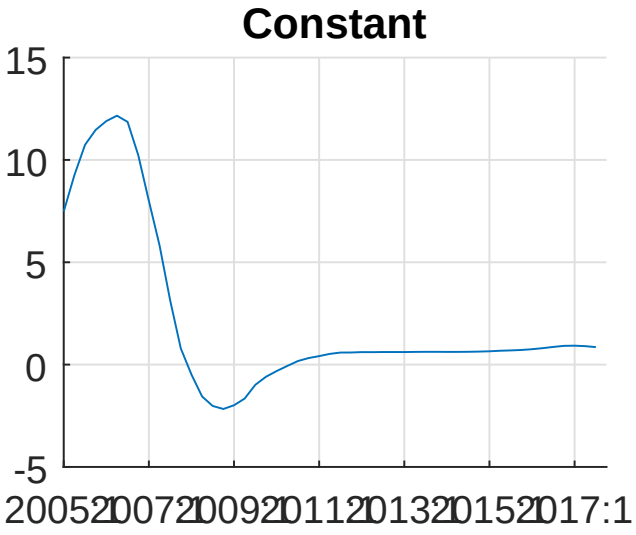
House Prices Regressions: Gaps



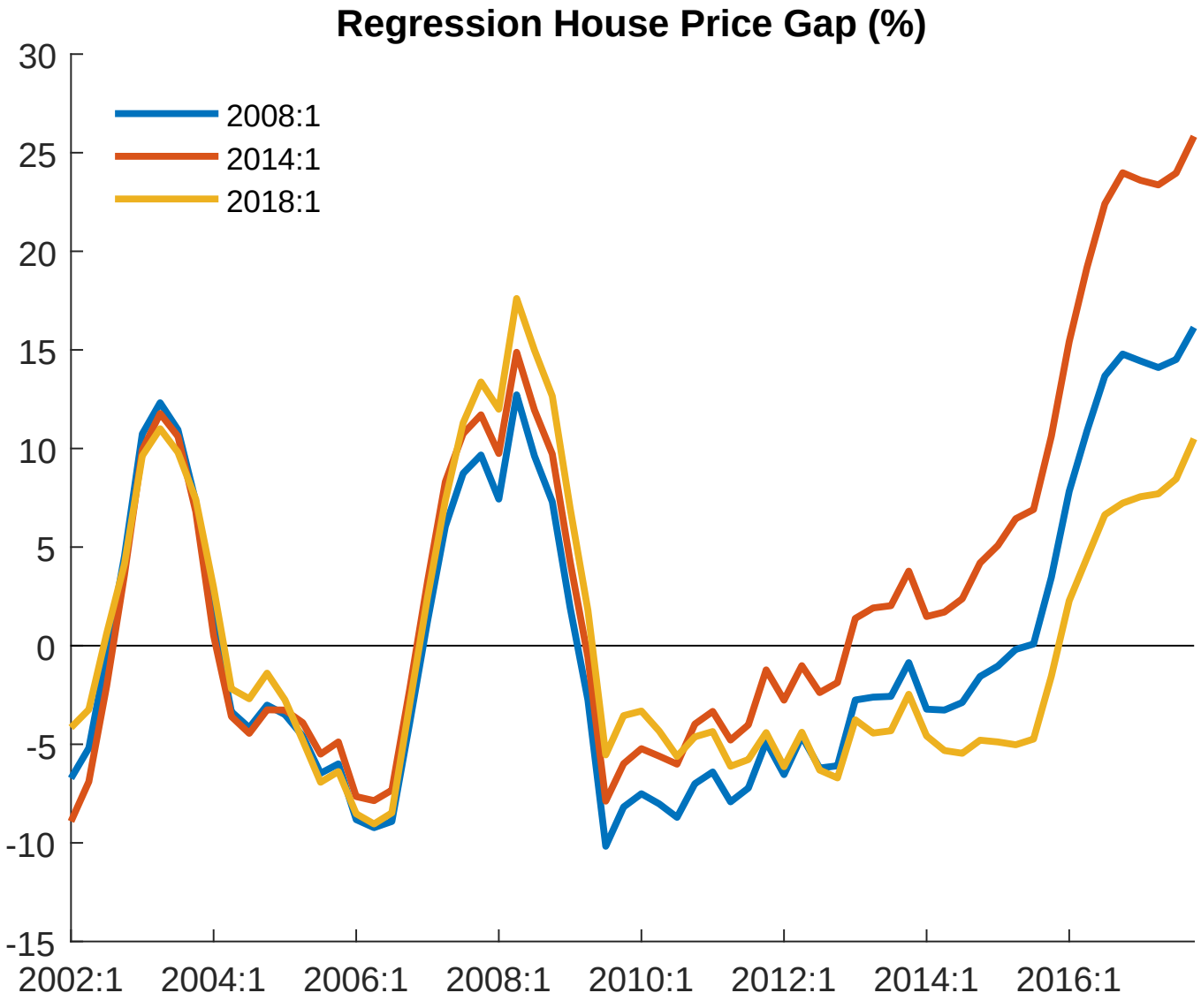
House Prices Regressions: Coefficients







House Prices Regressions: Sample Matters!



Macro vs. Micro

- All indicators we compute are **applicable at individual hosehold** and real-estate property level...
- Trivial to extend to countries, regions, and individual-level data
- We use macro data and rely on averages and/or medians

BORROWING CAPACITY

Borrowing Capacity (BC)

Borrowing Capacity:

House price implied by how much households can **safely borrow** given interest rates and their income. . .

Borrowing Capacity (BC)

Borrowing Capacity comes in flavors:

1. **Static Borrowing Capacity (SBC)**
   Considers current interest rate and income only.

2. **Dynamic, Look-Ahead BC**
   Based on current rates and income but considers growth of income and possible changes in rates. . .

3. **Dynamic, Look-Ahead BC with 'Offset/Safety Deposit'**
   Augments the Dynamic BC by allowing household to set aside money to lower their debt service. . .

Static Borrowing Capacity (SBC) – Logic

Given their income, Y, households can afford to pay mortgage annuity payment up to α percent of their income...

$$a_t = \alpha \times Y_t \tag{1}$$

Given mortgage rate, i_t, the mortgage annuity, a_t, uniquely determines the amount of the loan, L_t for N months:

$$L_t = \left[\frac{z_t(1 - z_t^N)}{(1 - z_t)} \right] \times a_t \text{ with } z_t \equiv \frac{1}{1 + i_t^m}. \tag{2}$$

With a down-payment given by loan-to-value of ltv, the affordable house price, is then

$$P_t^{sbc} = \frac{1}{ltv} \times L_t \tag{3}$$

Static Borrowing Capacity (SBC) – Formula

Put together:

$$P_t^{sbc} = \frac{1}{ltv_t} \times \left[\frac{z_t(1 - z_t^N)}{(1 - z_t)} \right] \times \alpha Y_t. \tag{4}$$

Dynamic Borrowing Capacity (DBC)

Dynamic (Look-Ahead) Borrowing Capacity:

- Given expected changes in income and interest rates, find maximum sustainable loan such that the debt service burden always stays within limits $\alpha_{t+i|t} < \alpha_{MAX}$ (ex-ante)
- This is an **asymmetric** measure, $P_t^{dbc} \leq P_t^{sbc}$
- When rates are expected to decline, DBC still prevents households from borrowing in excess of maximum static borrowing limit...

Dynamic Borrowing Capacity (DBC)

Dynamic Borrowing Capacity with Offset Deposit:

- Every period, households deposit the difference between the constant annuity payment, A, and $\alpha \times Y_{t+i|t}$ in a interest-bearing, liquid, security deposit...
- Households are allowed to **lower their debt service** using their savings and interest proceeds if $\alpha_{t+i} > \alpha_{max}$
- Find maximum sustainable loan **now** such that the expected debt service burden stays in the limit, given the option to use the offset account

BC Measures – Real-Time Implementation

Assumptions:

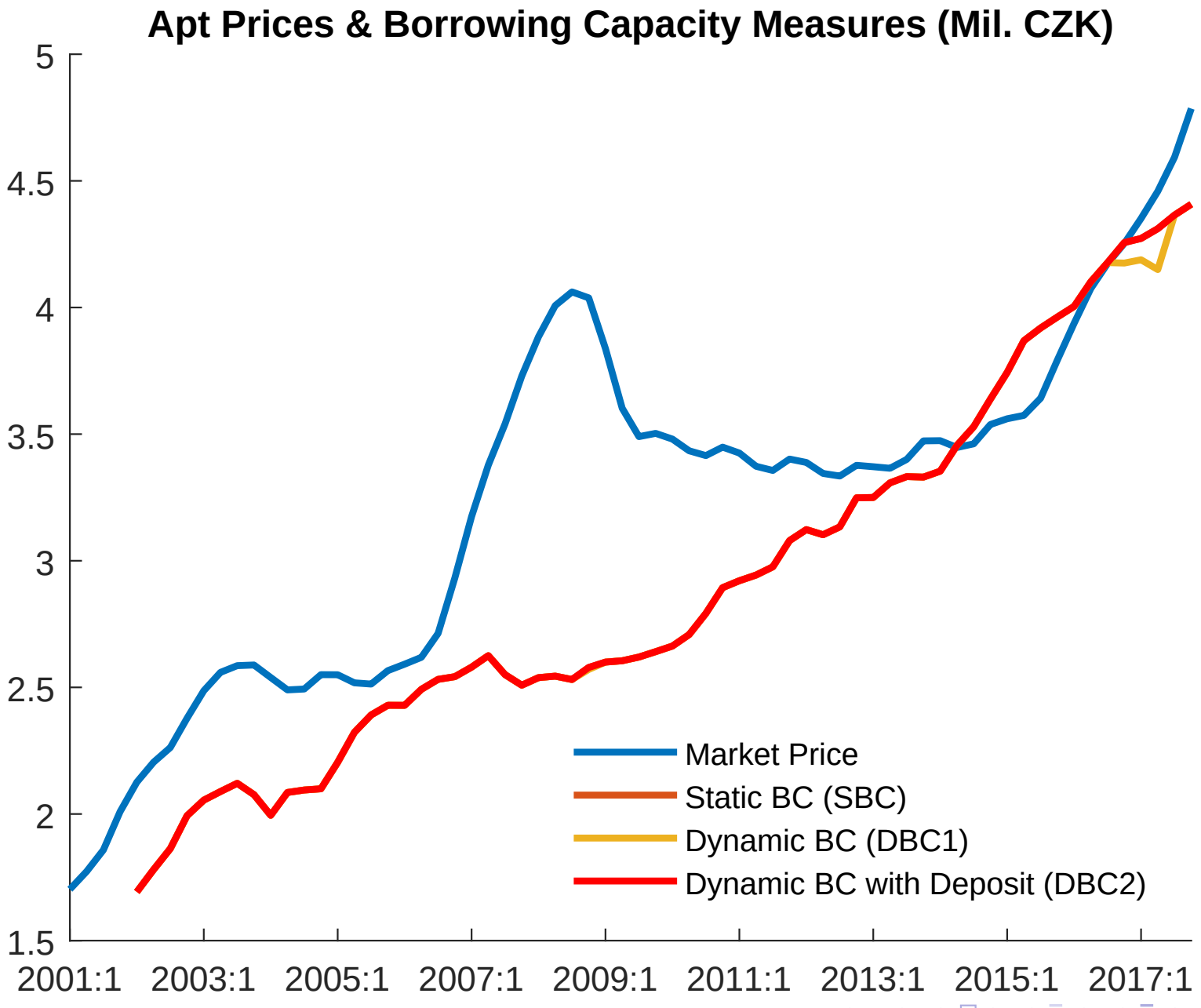
- Household Income, Y_t: 1.65$\times$ Household Disposable Income per capita
- Mortgate Rates, i_t: fix 5Y p.a. (2002-2003 spliced from GBCZ 5Y)
- Debt-Service Share of Income: $\alpha_{max} = 0.35$
- Loan-to-Value Ratio: $ltv = 0.8$
- Mortgage Duration: 25 years, 5 years re-financing

- Forecast of Income: CNB forecast + growth convergence to 4% in LR
- Forecast of Mortgage Rates: 5Y fix long-run value 5%
- Interest Rate on the 'Offset/Safety Deposit': Mortgage Rate - 100bp.

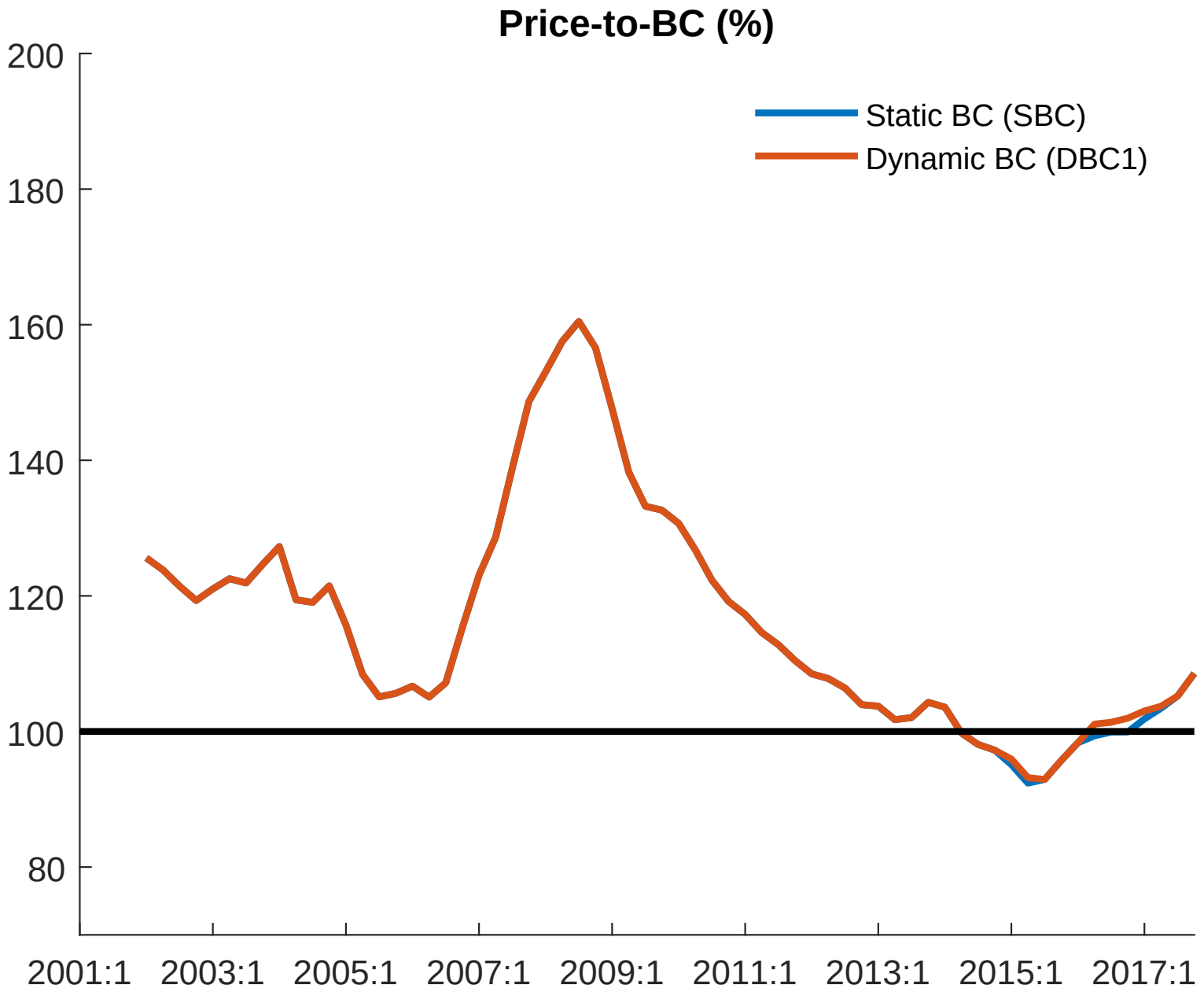
House Prices Data:

Czech Stat Office, Deloitte/'Cenova mapa' in Mil. CZK for 68m^2 apt.

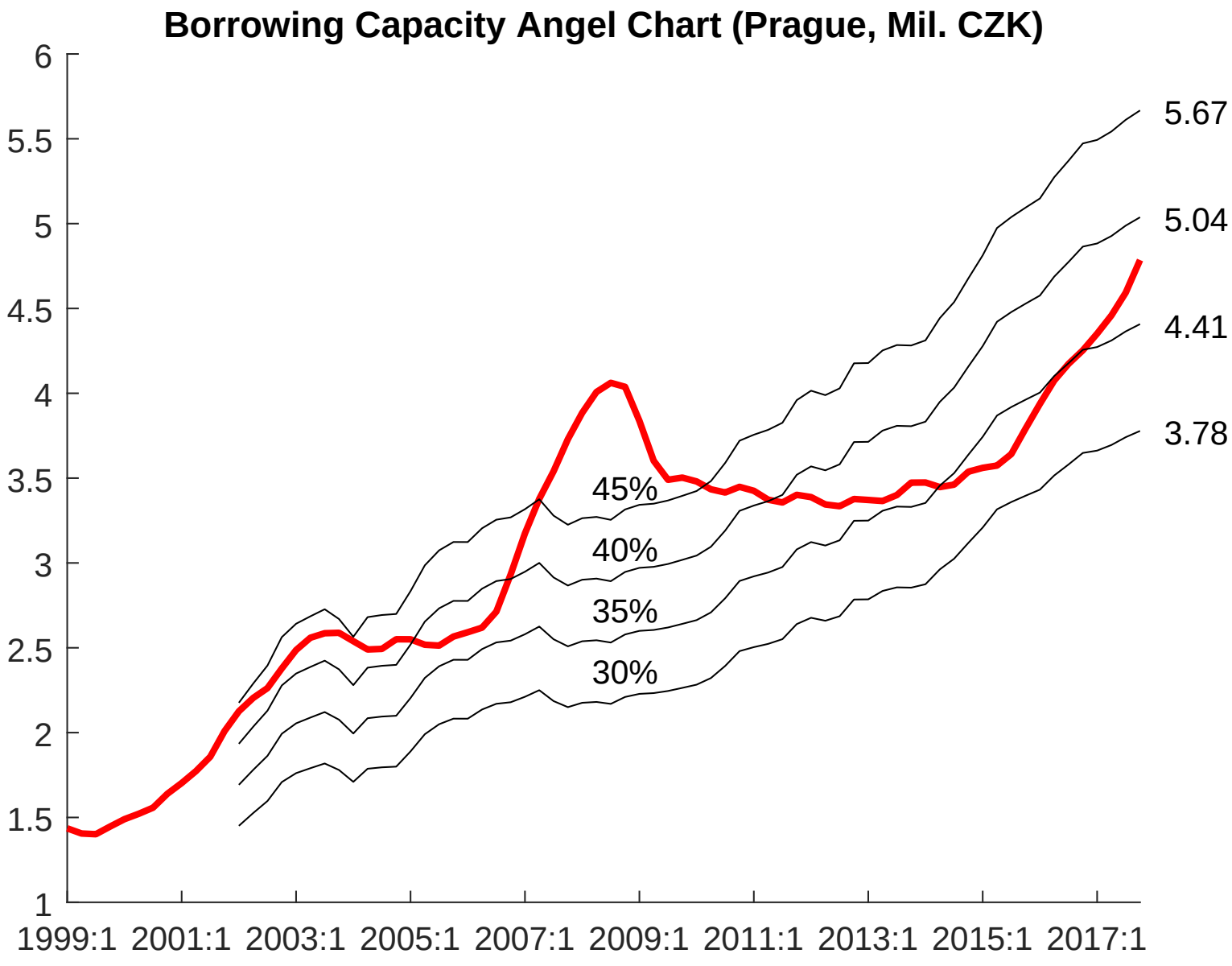
Results: Borrowing Capacity Measures



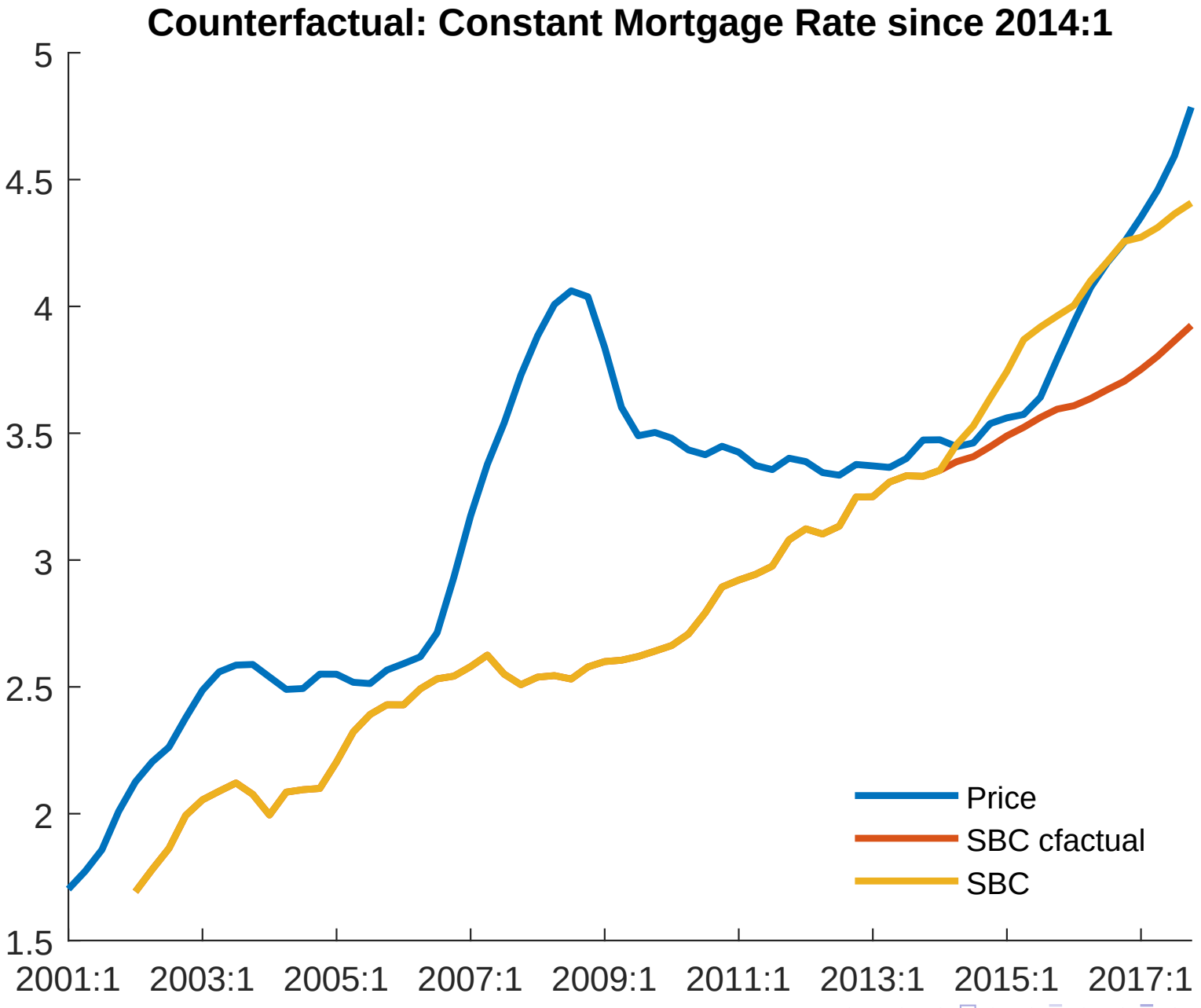
Results: Borrowing Capacity Measures



Results: Angel Chart for SBC

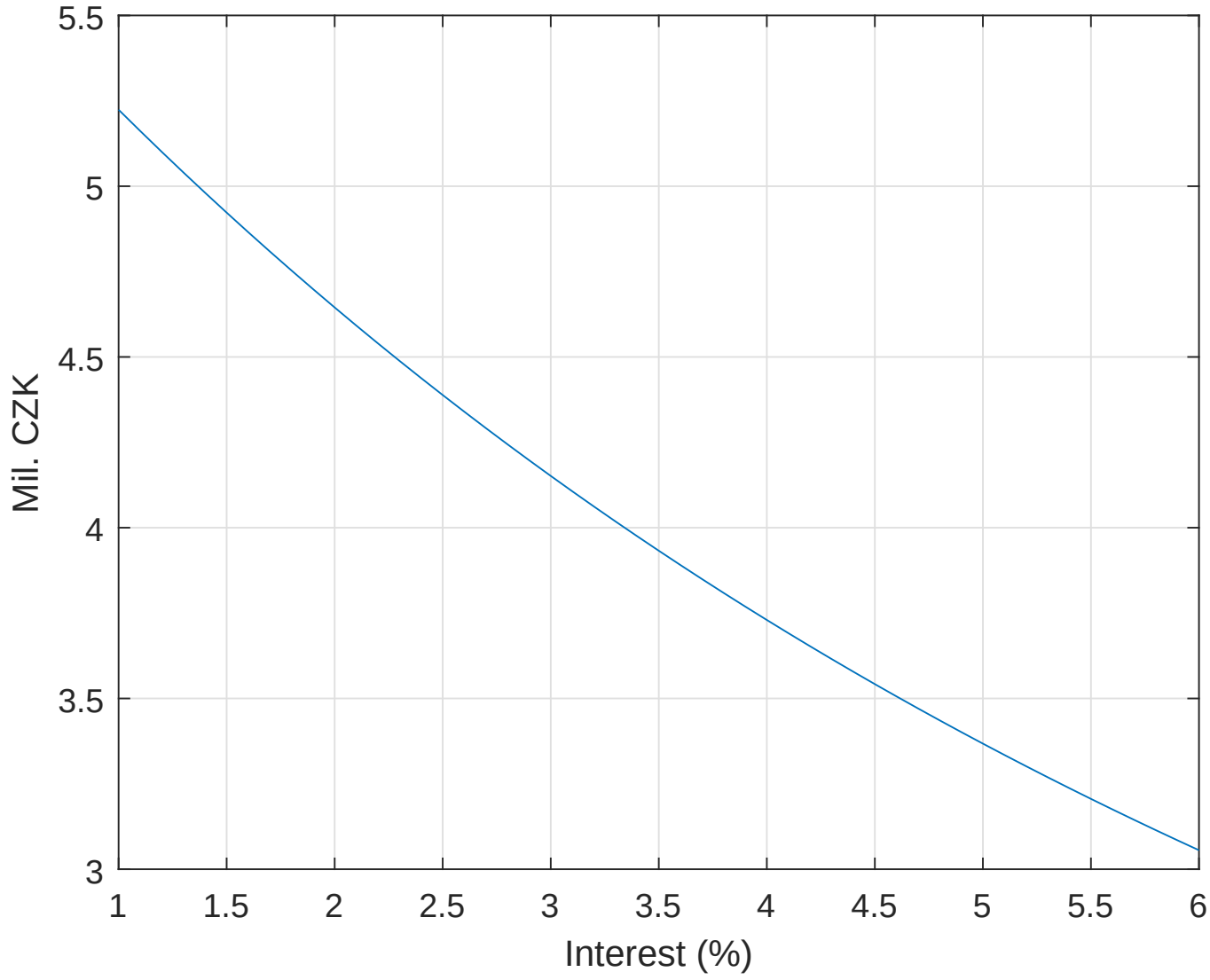


Counterfactual Scenario:



Sensitivity to Interest Rates

Household Income: 45k/month, $\alpha = 0.35$



Flexible Toolbox

House Price Assessment

Duration in Years

1 — 25 — 30

1 4 7 10 13 16 19 22 25 28 30

Interest Rate in %

2.3

Prudential DSTI limit

0.35

Net monthly income

0 — 45,000 — 100,000

Loan-to-Value Ratio

0.8

This application calculates three versions of the borrowing capacity

a) Static BC

b) Simple Look-Ahead BC

b) Look-Ahead BC with offset deposit

Price implied by the static borrowing capacity of households

4488600

INTRINSIC VALUE APPROACH

‘Fair Value’ – Investment Approach

House value is the net-present value of rental profits.

- **Forward-looking**, income and interest expectations are absolutely essential components
- Reflects mortgage structure and duration, tax structure, opportunity costs
- **We refine simplified models** from the literature and consider important real-life details, without adding complexity

Types of Investors

1. **Owner-Occupiers and Retail Buy-to-Let Investors**
   - Mostly re-pay their mortgage in full...

2. **Professional Investors**
   - No intentions to repay their mortgage, staying leveraged
   - Better access to financing than owner-occupiers
   - Different tax structure then retail
   - With large volumes, lower importance of transaction costs

Motivation: Stylized Rent-or-Buy Decision

Rent:

1. Take savings (downpayment), X_t and invest with return i_t^e
2. Pay the rent, $rent_t$

Buy:

1. Use downpayment, X_t and borrow L_t to buy a house at a price $P_t = X_t + L_t$, with LTV ratio $\phi \equiv L_t / P_t$
2. Face the mortgage rate i_t^m and pay $i_t^m L_t$
3. Pay the maintenance cost and property tax, $(\delta + \tau_p) P_t$
4. Interest payments are tax deductubile with the marginal tax rate τ
5. Sell the house at a price P_{t+1}

Motivation: Stylized Rent-or-Buy Decision

Assuming no arbitrage between **buy** and **rent** decisions:

$$P_t = rent_t + \frac{1}{1+z_t} P_{t+1|t} \tag{5}$$

with

$$(1+z_t) \equiv (1 + \underbrace{[(1-\phi) i_t^e + \phi * (1-\tau) i_t^m]}_{\text{cost of capital + tax shield}} + \delta + \tau_p) \tag{6}$$

Reasoning recursively for $P_{t+1}, \ldots, P_{t+T}$ and $T \to \infty$ we get an intuitive expression

$$\mathbf{P_t} = \sum_{\mathbf{i=0}}^{\infty} \frac{\mathbf{rent_{t+i|t}}}{\prod_{\mathbf{j=0}}^{\mathbf{i}} (\mathbf{1} + \mathbf{z_{t+j}})} \quad \text{and} \quad \mathbf{P_{ss}} = \frac{\mathbf{rent}}{\mathbf{z} - \mathbf{gn}} \tag{7}$$

Simple Formula Problems...

'Textbook formulas' have a few important assumptions:

- Constant loan-to-value ratio, ϕ, with households borrowing more to keep up with the price...
- Mortage with infinite duration (interest-only mortgage)
- Identical value of mortgage rate and other financial returns
- ...

Realistic Retail Investor Problem

Three-step present value computation:

1. First K years of current interest fixed, i_0^m
2. Remaining $N - K$ years of expected long-run interest, i_K^m
3. After N periods no mortgage payments, steady-state growth of rents, gn

Value of income flow to EQUITY holders:

- Rental cash flow adjusted for mortgage payments and tax deductions
- Income to equity discounted by cost of equity, i_t^e

Retail Investor Problem

$$
\begin{aligned}
V_{t|t} &= \sum_{i=0}^{K-1} \frac{(1-\tau)rent_{t+i|t} - mpay_{t+i|t} + \tau \times intcost_{t+i|t}}{\prod_{j=0}^{i}(1+i_{e,t+j|t})} \\
&+ \sum_{i=K}^{N-1} \frac{(1-\tau)rent_{t+i|t} - mpay_{t+i|t} + \tau \times intcost_{t+i|t}}{\prod_{j=0}^{i}(1+i_{e,t+j|t})} \\
&+ \frac{1}{\prod_{j=0}^{N}(1+i_{e,t+j|t})} \frac{gn \times (1-\tau)rent_{t+N|t}}{i_e - gn},
\end{aligned}
$$

Wonkish: Retail Investor Problem [Handout Only]

Assumptions:

- Mortgage lasts for N years and household fully repay the loan
- Mortgage payments follow the exact amortization schedule as in commercial banks, based on monthly compounding
- The initial mortgage rate is i_0^m and will be fixed for K years, until a new and final rate is assumed, i_K^m
- Households face a particular loan-to-value requirement
- Interest-rate component of the mortgage payment is tax deductible
- Rent is a given share of household disposable income, $rent = \alpha \times Y$
- In the long-run nominal income growts at a rate gn
- The opportunity cost of households is i_e

Prague House Prices: Parameterization

Parameterization:

- Mortgage lasts 25 years, re-financing in 5
- Mortgage rates for 3Y-5Y mortgages

- Household income is 1.65$\times$ the average local income
- Rent is 35% of income
- Opportunity cost of households is 6.5%

- Marginal tax rate 15%
- Long-run mortgage rates 5%
- Long-run nominal income growth is 4%

- Medium-term income growth forecast sourced from the CNB forecast archives starting from 2008Q3

Prague House Prices: Rent and Income Forecasts

The expected path of rents is a key component of the valuation.

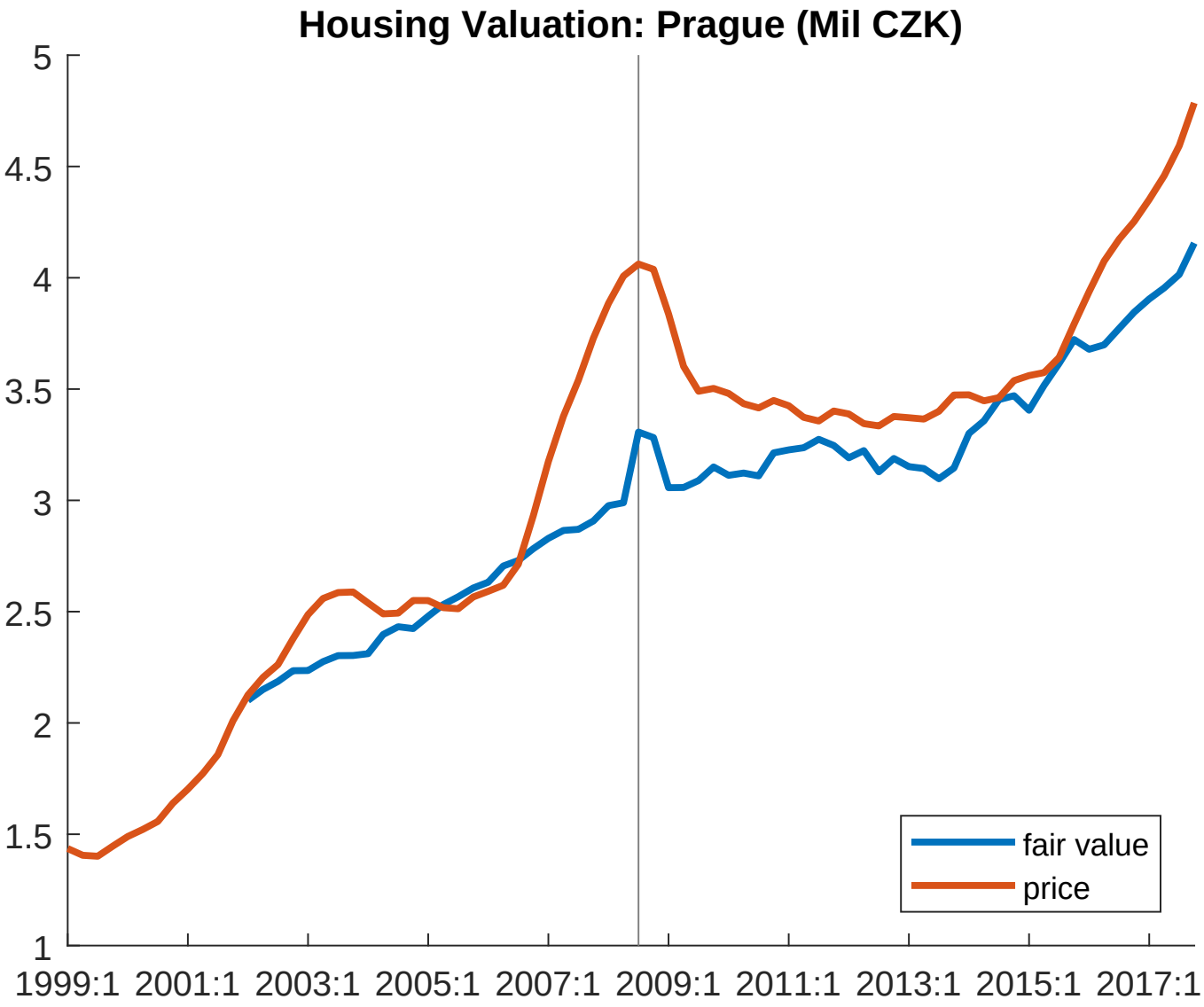
Income growth beyond CNB forecast horizon extended by an AR(1) process:

Case A:
With **realistic** persistence ρ (realistic wage growth)

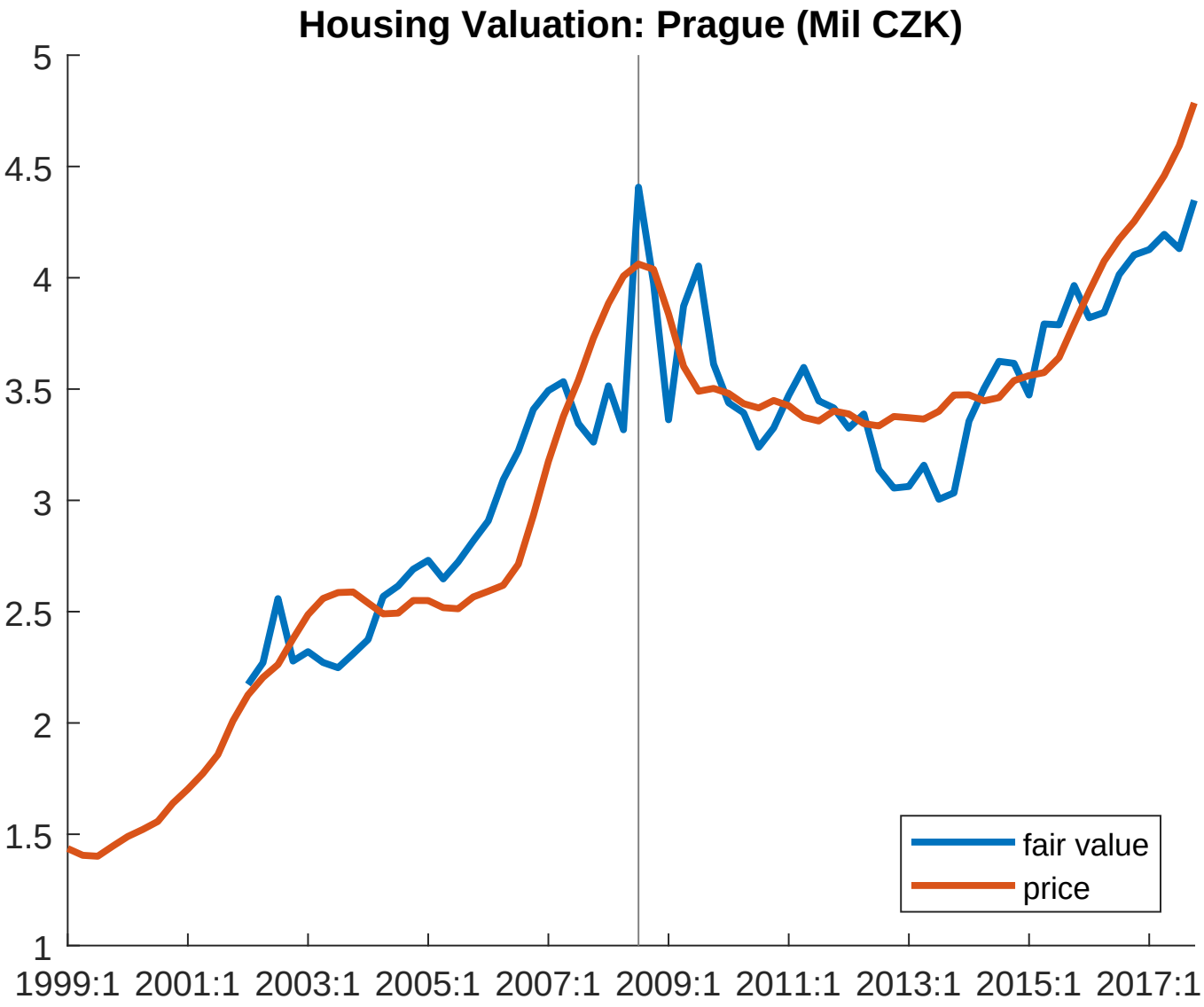
Case B:
With **very high** persistence ρ (optimistic wage growth)

Case C:
No CNB forecast are used, a realistic AR(1) process for income

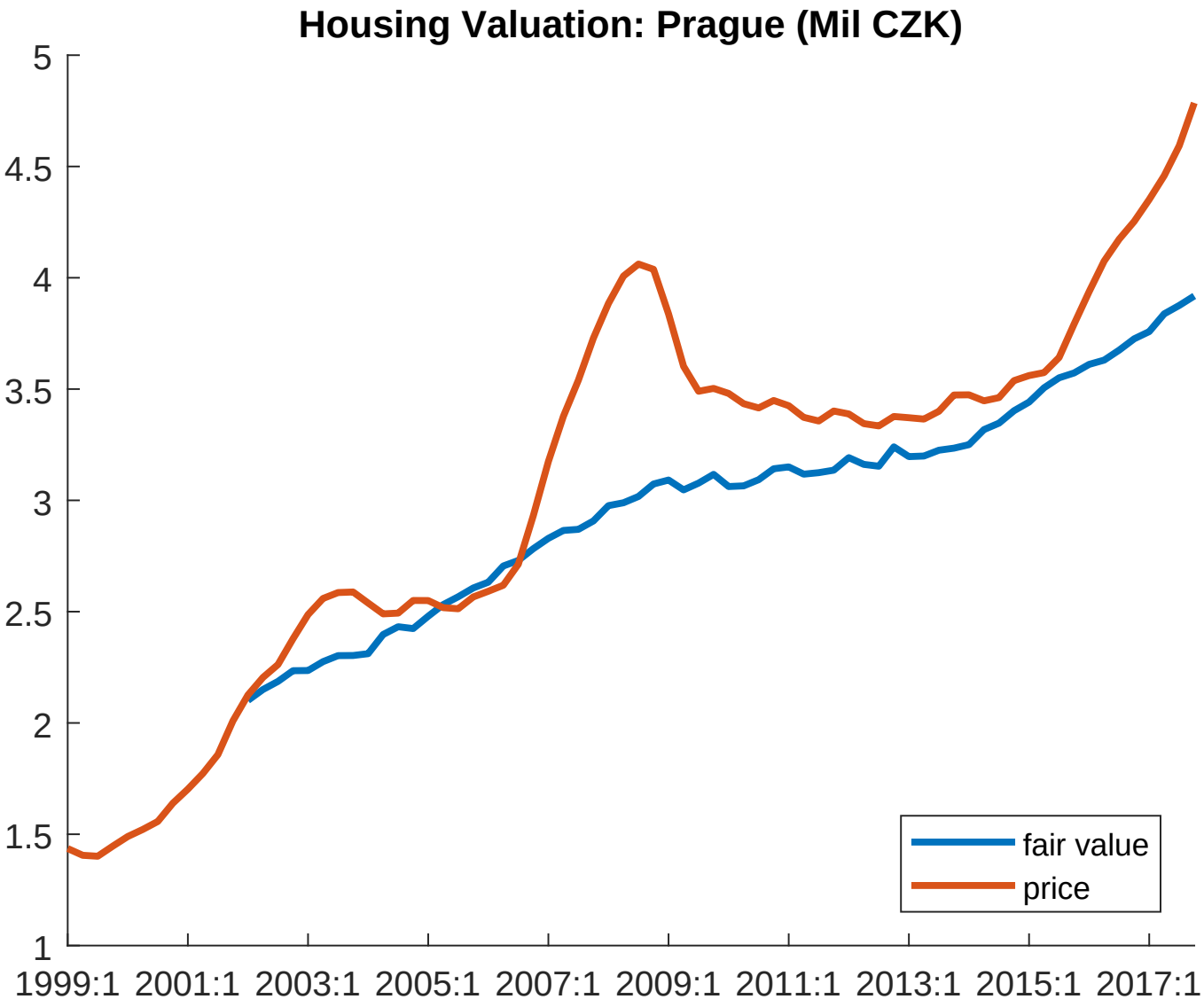
Prague House Prices: Case A (CNB + low ρ)



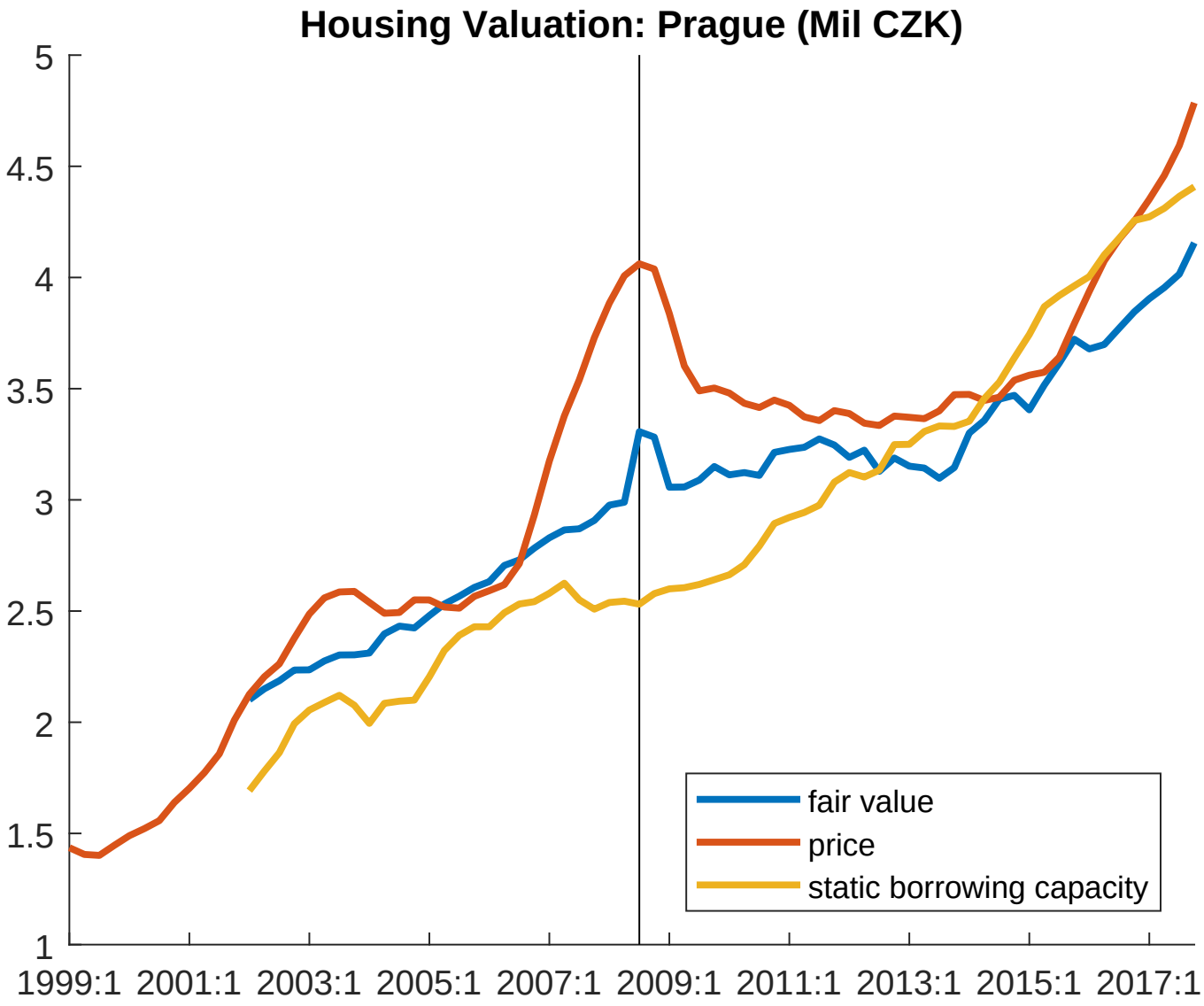
Prague House Prices: Case B (CNB + high ρ)



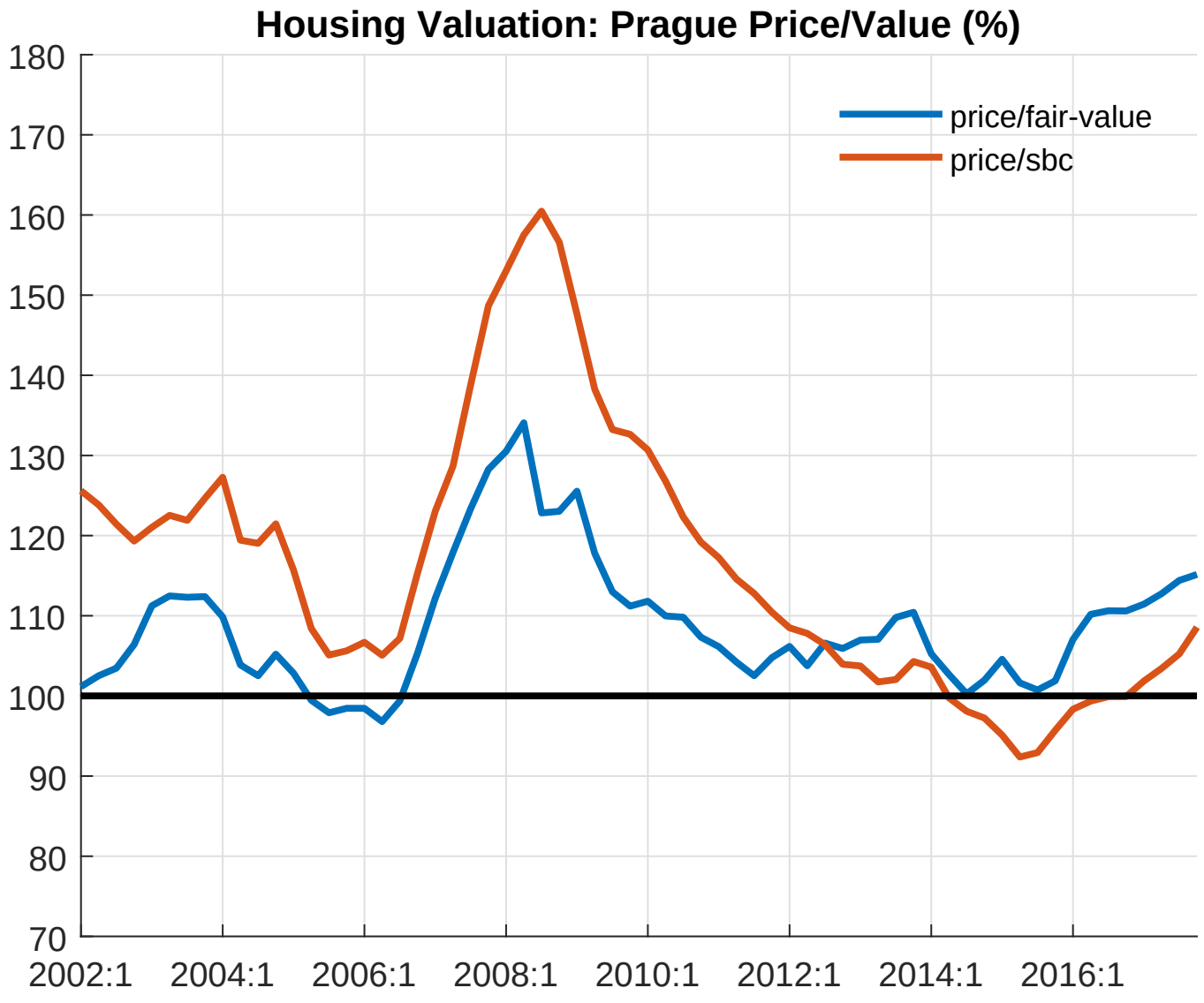
Prague House Prices: Case C – no CNB forecast



Prague House Prices: Case A & SBC



Prague House Prices: Case A & SBC



Re-Cap: Borrowing Capacity or Fair-Value?

Shared features:

- Neither is a forecast of house prices
- Both are frameworks for thinking about house prices
- Both reflect current income and interest rates. . .

- Both do not require past data
- House prices do not enter the valuation formulas

Differences:

- Borrowing Capacity less forward-looking and asymmetric
- Investor's approach also reflects opportunity cost and tax code

. . . and Nothing Else Matters?

Sure it does!

Demographics, supply constraints, regulation, . . .

- Most factors reflected in income, interest rates, . . .
- Demographic changes are predictable and rarely abrupt
- Supply-side constraints are usually transitory
- Inter-city mobility must be profitable (expensive rents lower competitiveness)

It is important to avoid 'analysis paralysis'

Recognizing Uncertainty...

- The framework itself invites to scenario analysis...
- Introducing scenarios and uncertainty about income and interest development is conceptually simple
- Things should be kept simple and explainable, avoding pretense of knowledge...

Flexible Toolbox

- This is a **toolbox** and a **calculator.**
- No econometrics needed. . .
- No historical data for estimation needed, forecasts not tied to a particular model, links to anything
- Natural to create **scenario analysis** and **counterfacutals**, or **sensitivity analysis**

Flexible Toolbox

House Price Assessment

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Conclusions

Borrowing Capacity and Fair-Value indicators are:

- Simple to compute
- Intuitive and based on economic fundamentals
- Available in real time
- Not prone to revisions due to change in sample size
- Not based on ad-hoc least-squares regressions...

Thank you for your patience. . .