Portfolio Choice with House Value Misperception*

Stefano Corradin
ECB

José L. Fillat
FRB Boston

Carles Vergara-Alert
IESE

May 5, 2016

*The views expressed in this paper are those of the authors and do not represent those of the Federal Reserve System, Federal Reserve Bank of Boston, or European Central Bank.

INTRODUCTION

Contribution: Misperception Matters!

In this paper

- We present evidence on housing value misperception, sign, and size

Contribution: Misperception Matters!

In this paper

- We present evidence on housing value misperception, sign, and size
- Develop a model of portfolio allocation with costly acquisition of information,

Contribution: Misperception Matters!

In this paper

- We present evidence on housing value misperception, sign, and size
- Develop a model of portfolio allocation with costly acquisition of information,
  - which results in households misvaluing their houses
  - misperception matters for portfolio, housing, and consumption decisions (spoiler: increases risk aversion)

Contribution: Misperception Matters!

In this paper

- We present evidence on housing value misperception, sign, and size
- Develop a model of portfolio allocation with costly acquisition of information,
  - which results in households misvaluing their houses
  - misperception matters for portfolio, housing, and consumption decisions (spoiler: increases risk aversion)
- Test model implications with household level data on financial wealth, housing, and portfolio allocation.

FEDERAL RESERVE BANK OF BOSTON™

Contribution: Misperception Matters!

In this paper

- We present evidence on housing value misperception, sign, and size
- Develop a model of portfolio allocation with costly acquisition of information,
  - which results in households misvaluing their houses
  - misperception matters for portfolio, housing, and consumption decisions (spoiler: increases risk aversion)
- Test model implications with household level data on financial wealth, housing, and portfolio allocation.

Evidence on misperception (too long list), but evidence on sign is mixed (and very relevant for portfolio allocations)

- Benitez-Silva et al. (2008), Agarwal (2007) → overvaluation
- Follain and Malpezzi (1981), Goodman and Ittner (1992) → undervaluation

Misperception Definition

Evidence on misperception:

- self-reported housing values vs "market" housing values
- market values built from purchase date (=zero misperception) using price index
  - perceived housing wealth rarely equals market housing wealth

Misperception Definition

Evidence on misperception:

- self-reported housing values vs “market” housing values
- market values built from purchase date (=zero misperception) using price index
  - perceived housing wealth rarely equals market housing wealth

Data

- PSID at zipcode level $\rightarrow$ self reported house value
- CoreLogic at zipcode level $\rightarrow$ market value

Misperception Definition

Evidence on misperception:

- self-reported housing values vs "market" housing values
- market values built from purchase date (=zero misperception) using price index
  - perceived housing wealth rarely equals market housing wealth

Data

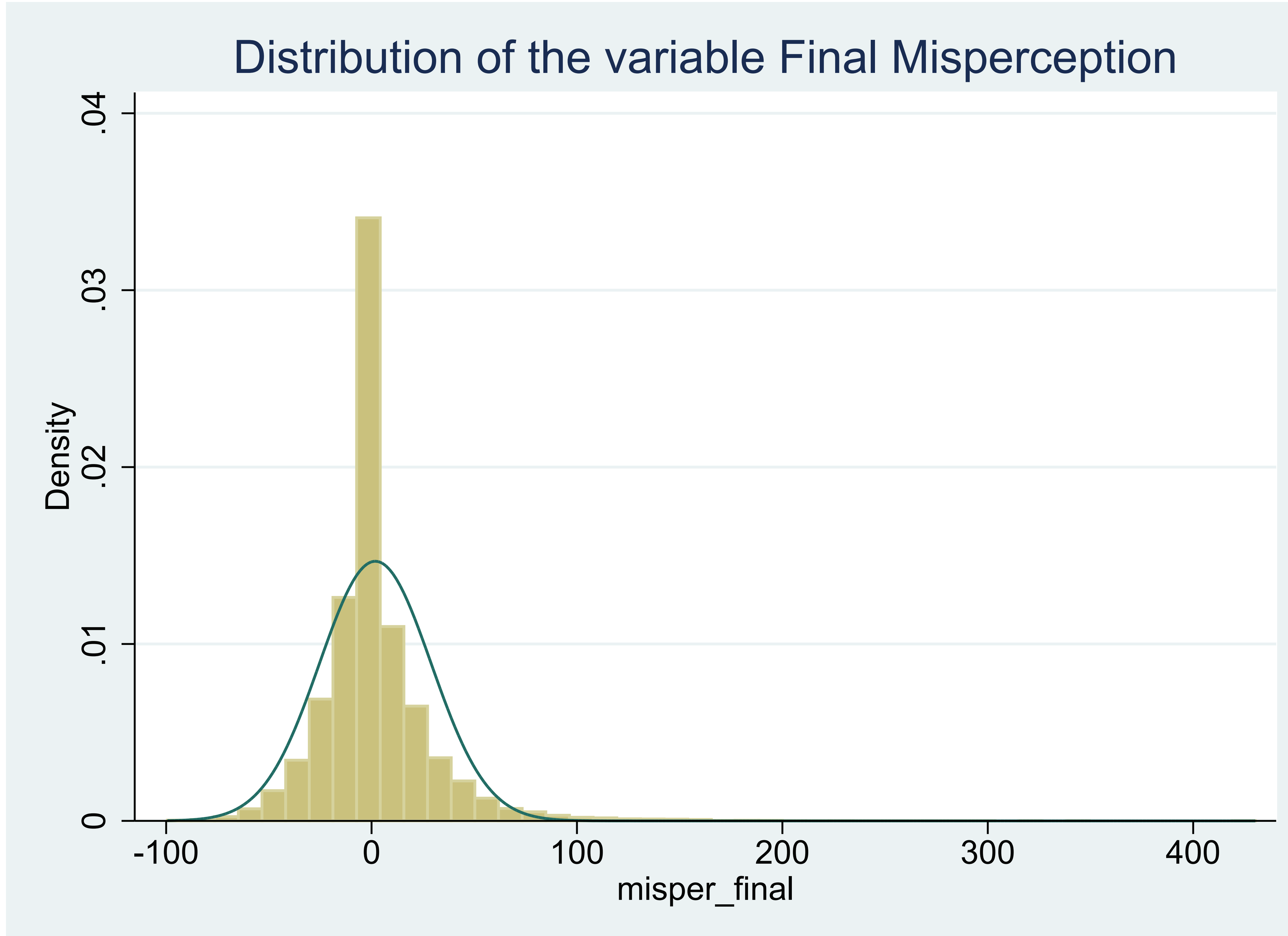
- PSID at zipcode level $\rightarrow$ self reported house value
- CoreLogic at zipcode level $\rightarrow$ market value

Use the CL HPI index to inflate purchase price of house.

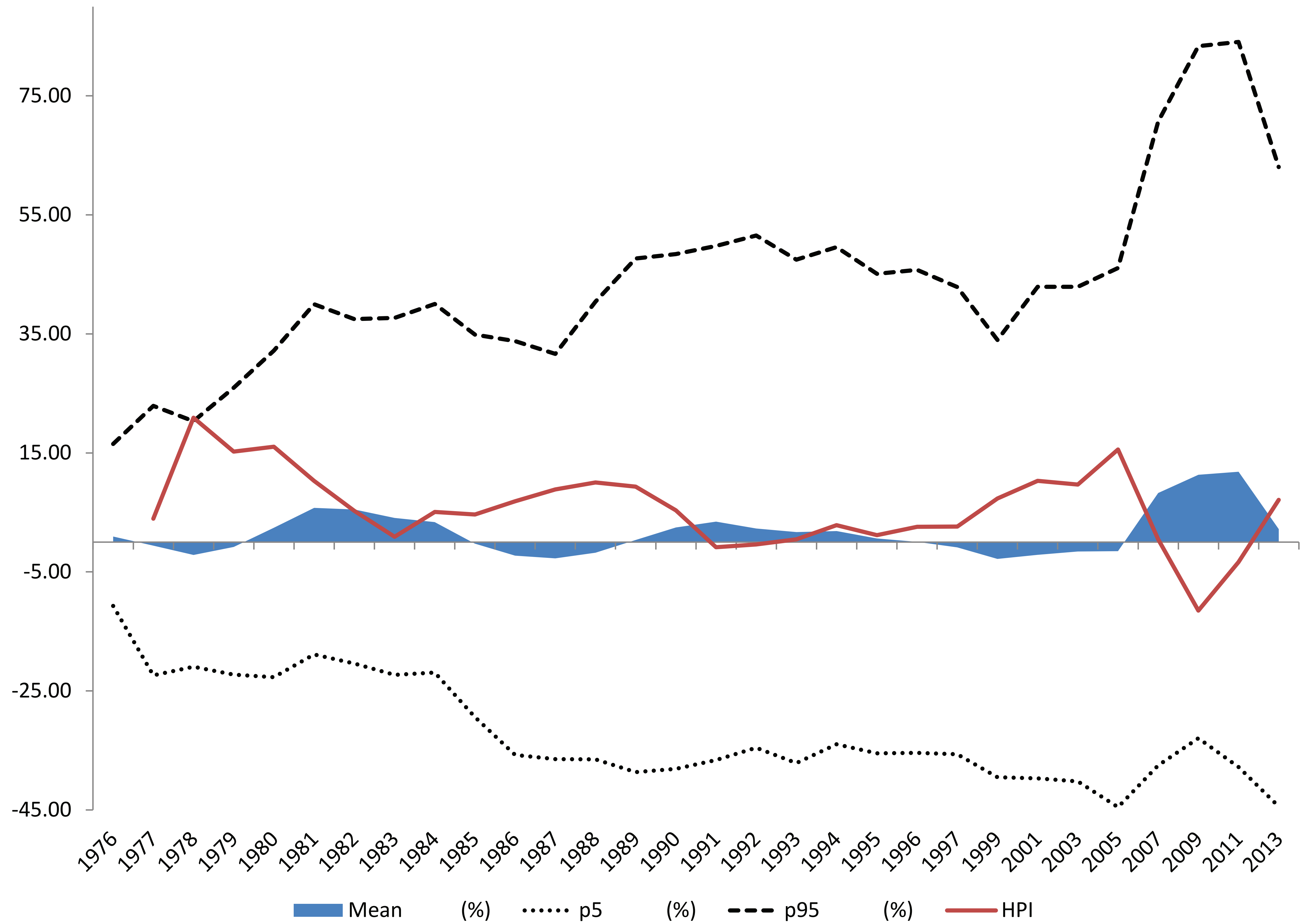
- $\textit{Misperception} = (H \cdot P_{H,t}^{PSID}) - (H \cdot P_{H,0}^{PSID} \times \Delta HPI_{0 \rightarrow t}^{CL})$

MISPERCEPTION

Distribution of Misperception



Misperception cyclicality



Misperception is Persistent

	1 − 2	3	4	5	6	7	8
1984	**−3.06**	**−3.29**	**0.22**	7.41	11.93	6.44	15.33
1985	**−4.18**	**−5.16**	**−7.43**	**−4.29**	5.05	6.58	2.94
1986	**−9.49**	**−5.09**	**−7.20**	**−9.76**	**−3.88**	1.72	7.41
1987	**−7.53**	**−4.11**	**−9.40**	**−5.55**	**−10.97**	**−1.58**	1.09
1988	**−1.36**	**−5.68**	**−3.35**	**−7.04**	**−6.19**	**−12.89**	**−0.39**
1989	2.94	**0.88**	3.17	**−1.36**	**−7.85**	**−1.76**	**−10.69**
1990	1.11	6.45	2.58	**−1.07**	**0.40**	**0.97**	**−1.53**
1991	1.67	5.60	9.40	3.77	2.26	2.05	2.02
1992	**−1.85**	2.72	2.45	11.36	2.81	**−0.26**	2.90
1993	1.68	**−3.35**	0.98	3.28	4.88	3.05	**−2.86**
1994	**−0.17**	**−2.46**	**−3.98**	1.49	5.21	6.08	3.36
1995	**−1.17**	**−1.76**	**−3.43**	**−6.14**	1.06	4.79	8.58
1996	**−0.64**	**−3.96**	**−2.04**	**0.29**	**−7.63**	**0.03**	2.80
1997	**−1.04**	**−0.56**	**−6.54**	**−3.74**	**−1.35**	**−8.77**	**−3.93**
1999	**−6.56**	**−4.86**	**−3.86**	**−7.60**	**−3.59**	**−4.71**	**−9.21**
2001	2.86	**−8.34**	**0.96**	**−4.84**	**−8.85**	**−0.70**	**−3.00**
2003	**0.14**	**0.96**	−10.41	−0.17	**−3.73**	**−2.97**	3.28
2005	1.19	**−0.54**	**−0.20**	**−13.84**	**−5.17**	**−1.41**	**−2.20**
2007	14.82	11.42	9.09	17.61	**−4.18**	17.10	10.04
2009	8.03	25.42	17.33	12.65	16.69	**−3.12**	18.34
2011	1.63	7.50	26.77	17.18	12.87	21.33	8.61
2013	**−6.14**	**−3.66**	**−0.70**	13.09	5.99	1.25	4.66
Average	0.07	0.57	1.41	2.19	1.10	1.76	2.57

Risky stock holdings are persistent too

	1985	1990	1995	2000	2002	2004	2006	2008
1984	0.015	0.029	**0.078**					
1989		0.027	**0.057**	0.023	0.028			
1994			**0.038**	**0.050**	**0.044**	**0.054**	**0.068**	**0.086**
1999				0.024	**0.041**	**0.047**	**0.041**	0.033
2001					**0.043**	0.026	0.034	**0.040**
2003						0.023	0.033	0.029
2005							0.024	0.025
2007								0.021

Median $= 0.037$

FEDERAL RESERVE BANK OF BOSTON™

Preview of Results

- Misperception of housing wealth affects portfolio, consumption, and housing decisions

Preview of Results

- Misperception of housing wealth affects portfolio, consumption, and housing decisions
- Households' value of their houses differs from market value

Preview of Results

- Misperception of housing wealth affects portfolio, consumption, and housing decisions
- Households' value of their houses differs from market value

$\uparrow$ **Misvaluation** $\Rightarrow$ { **less risky investments**

Preview of Results

- Misperception of housing wealth affects portfolio, consumption, and housing decisions
- Households' value of their houses differs from market value

$\uparrow$ **Misvaluation** $\Rightarrow$
- **less risky investments**
- **lower consumption and lower leverage**

FEDERAL RESERVE BANK OF BOSTON™

Preview of Results

- Misperception of housing wealth affects portfolio, consumption, and housing decisions
- Households' value of their houses differs from market value

$$\uparrow \textbf{Misvaluation} \Rightarrow \begin{cases} \textbf{less risky investments} \\ \textbf{lower consumption and lower leverage} \\ \textbf{larger housing relative to total wealth} \end{cases}$$

Preview of Results

- Misperception of housing wealth affects portfolio, consumption, and housing decisions
- Households' value of their houses differs from market value

$\uparrow$ **Misvaluation** $\Rightarrow$

- **less risky investments**
- **lower consumption and lower leverage**
- **larger housing relative to total wealth**
- **more frequent acquisition of information**

FEDERAL RESERVE BANK OF BOSTON™

DATA

PSID Data

- household sample 1978-2013

PSID Data

- household sample 1978-2013
- Financial wealth = house value (first and second), business value, other assets, stock holdings, checking and savings valances, IRAs and annuities, less the mortgage principal on primary residence

PSID Data

- household sample 1978-2013
- Financial wealth = house value (first and second), business value, other assets, stock holdings, checking and savings valances, IRAs and annuities, less the mortgage principal on primary residence
- All net of debt

PSID Data

- household sample 1978-2013
- Financial wealth = house value (first and second), business value, other assets, stock holdings, checking and savings valances, IRAs and annuities, less the mortgage principal on primary residence
- All net of debt
- Only owners

PSID Data

- household sample 1978-2013
- Financial wealth = house value (first and second), business value, other assets, stock holdings, checking and savings valances, IRAs and annuities, less the mortgage principal on primary residence
- All net of debt
- Only owners
- Identify movers, start measuring misperception at purchase time
  - misperception is assumed to be **zero** at purchase

CoreLogic House Prices

- Repeat sales index (monthly, starting 1975), single family combined

CoreLogic House Prices

- Repeat sales index (monthly, starting 1975), single family combined
- public record files from First American

CoreLogic House Prices

- Repeat sales index (monthly, starting 1975), single family combined
- public record files from First American
- Representative of all loans (not just GSEs)

CoreLogic House Prices

- Repeat sales index (monthly, starting 1975), single family combined
- public record files from First American
- Representative of all loans (not just GSEs)
- Limited coverage at the zipcode level

Use the index to inflate purchase price of house, starting at purchase time

- $\textit{Misperception} = \left(H \cdot P_{H,t}^{PSID}\right) - \left(H \cdot P_{H,0}^{PSID} \times \Delta HPI_{0\to t}^{CL}\right)$

MODEL

Model

$$u(C,H) = \frac{1}{1-\gamma}(C^{\beta}H^{1-\beta})^{1-\gamma}$$
$$dH = -\delta H dt$$
$$dP = P\mu dt + P\sigma dZ_2$$
$$dB = rBdt$$
$$dS = S\ \alpha_S dt + S\ \sigma_S dZ_1$$
$$W = B + \Theta + HP$$

Notation:

$P \equiv$ house price

$S \equiv$ stock price

$\Theta \equiv$ financial wealth in risky stock

$B \equiv$ financial wealth in safe assets

$\phi_o \equiv$ cost of acquiring info

$\phi_a \equiv$ cost of moving

$m^i \equiv$ market value "surprise"

Model cont'd

Value function *for acquiring information*

$$
\begin{aligned}
V(W,H,P) = \max_{C,\Theta,H',\tau} E \Bigg[\int_0^\tau u(C, He^{-\delta t})dt \\
+ \mathbb{I}_{H'>H} e^{-\rho\tau}(1-\pi)V\left(W(\tau), He^{-\delta\tau}, P(\tau)\right) + \pi\widetilde{V}\left(W(\tau), H(\tau), P(\tau)\right) \\
+ \mathbb{I}_{H'<H} e^{-\rho\tau}\pi V\left(W(\tau), He^{-\delta\tau}, P(\tau)\right) + (1-\pi)\widetilde{V}\left(W(\tau), H(\tau), P(\tau)\right) \Bigg]
\end{aligned}
$$

$$
\begin{aligned}
W(\tau) &= W(\tau^-) - \phi_o P(\tau)H(\tau^-) + m^i P(\tau^-)H(\tau^-) \\
P(\tau) &= P(\tau^-)(1+m^i) \\
H(\tau) &= H' \text{ and } H(\tau^-) = He^{-\delta\tau}
\end{aligned}
$$

Model cont'd

Value function *for acquiring information*

$$
\begin{aligned}
V(W,H,P) = \max_{C,\Theta,H',\tau} E\Bigg[\int_0^{\tau} u(C, He^{-\delta t})dt \\
+ \mathbb{I}_{H'>H} e^{-\rho\tau}(1-\pi)V\left(W(\tau), He^{-\delta\tau}, P(\tau)\right) + \pi\widetilde{V}\left(W(\tau), H(\tau), P(\tau)\right) \\
+ \mathbb{I}_{H'<H} e^{-\rho\tau}\pi V\left(W(\tau), He^{-\delta\tau}, P(\tau)\right) + (1-\pi)\widetilde{V}\left(W(\tau), H(\tau), P(\tau)\right)\Bigg]
\end{aligned}
$$

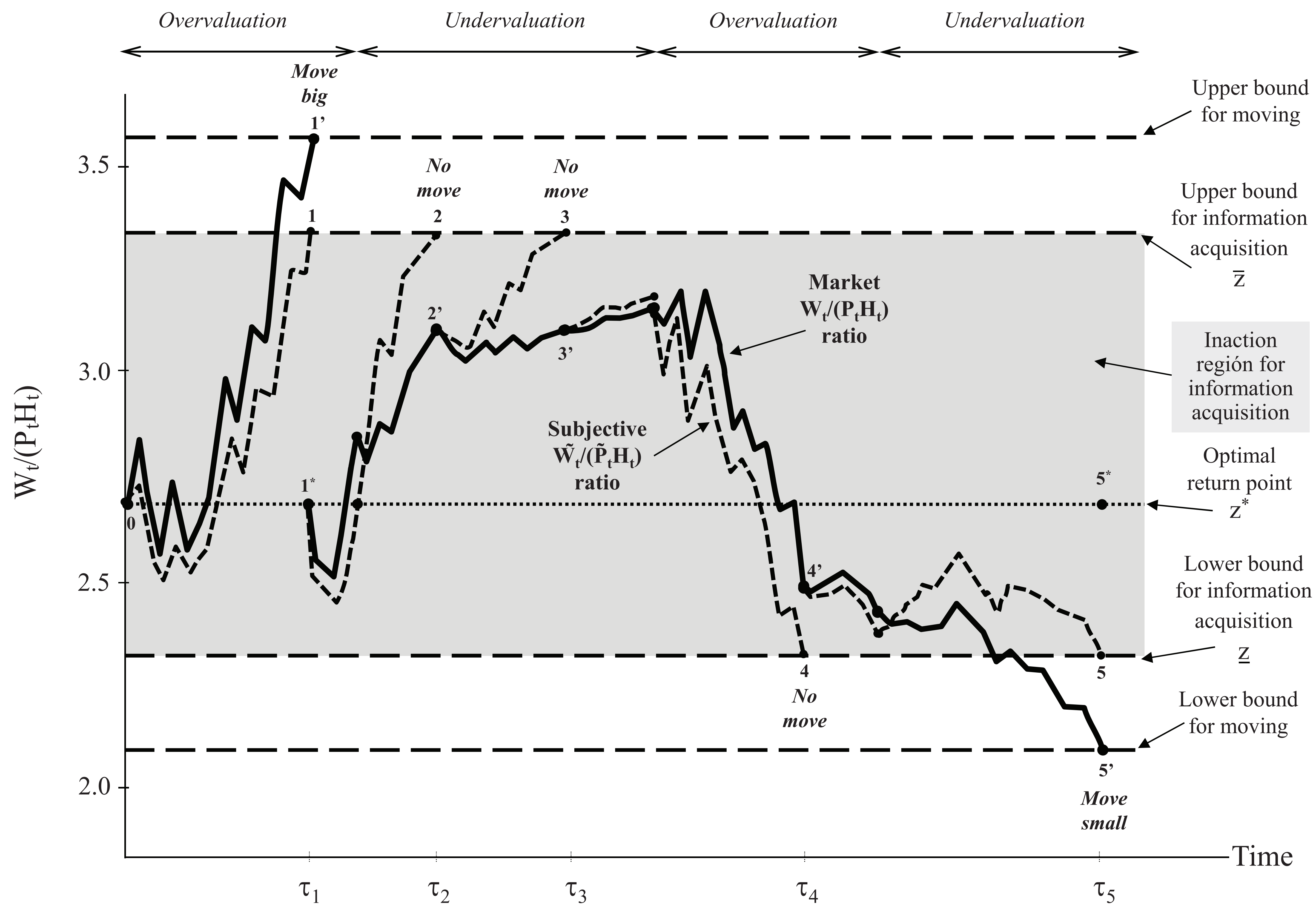
$$
\begin{aligned}
W(\tau) &= W(\tau^-) - \phi_o P(\tau)H(\tau^-) + m^i P(\tau^-)H(\tau^-) \\
P(\tau) &= P(\tau^-)(1+m^i) \\
H(\tau) &= H' \text{ and } H(\tau^-) = He^{-\delta\tau}
\end{aligned}
$$

Value function *of adjusting housing*

$$
\widetilde{V}(W,H,P) = \max_{C,\Theta,H',\tau} E\left[\int_0^{\tau} u(C, He^{-\delta t})dt + e^{-\rho\tau}\widetilde{V}\left(W(\tau), H(\tau), P(\tau)\right)\right],
$$

where $W(\tau) = W(\tau^-) - \phi_a P(\tau)H(\tau^-) - \phi_o P(\tau)H(\tau^-) + m^i P(\tau^-)H(\tau^-)$.

Illustration of equilibrium



Equilibrium

The value function of this problem, $V(W(t), H(t), P(t))$, satisfies the following Hamilton-Jacobi-Bellman (HJB) partial differential equation

$$\sup_{C,\Theta,H',\tau} E\left(dV\left(W, H, P\right) + u\left(C, H\right)dt\right) = 0.$$

Equilibrium

The value function of this problem, $V(W(t), H(t), P(t))$, satisfies the following Hamilton-Jacobi-Bellman (HJB) partial differential equation

$$\sup_{C,\Theta,H',\tau} E\left(dV\left(W,H,P\right)+u\left(C,H\right)dt\right) \;=\; 0.$$

Thanks to homogeneity properties, we can rewrite the problem in terms of the wealth-to-housing ratio, $z = W/(PH)$

$$V(W,H,P) = H^{1-\gamma}P^{\beta(1-\gamma)}\;V\left(\frac{W}{PH},1,1\right) = H^{1-\gamma}P^{\beta(1-\gamma)}v\left(z\right).$$

and solve for $v(z)$. c denotes the scaled control $c = C/(PH)$ and θ the scaled control $\theta = \Theta/(PH)$.

Solution

Solution: Portfolio Allocation and Consumption

Given a wealth-to-housing ratio z, where $v(z) > M\frac{(z+1-\phi_o)^{1-\gamma}}{1-\gamma}$, the agent chooses a optimal consumption $c^*(z)$ and portfolio $\theta^*(z)$ and $b^*(z)$

$$c^*(z) = \left(\frac{v_z(z)}{\beta}\right)^{1/(\beta(1-\gamma)-1)}$$

$$\theta^*(z) = -\omega\frac{v_z(z)}{v_{zz}(z)} + \frac{\rho_{PS}\sigma_P}{\sigma_S}(z-1)$$

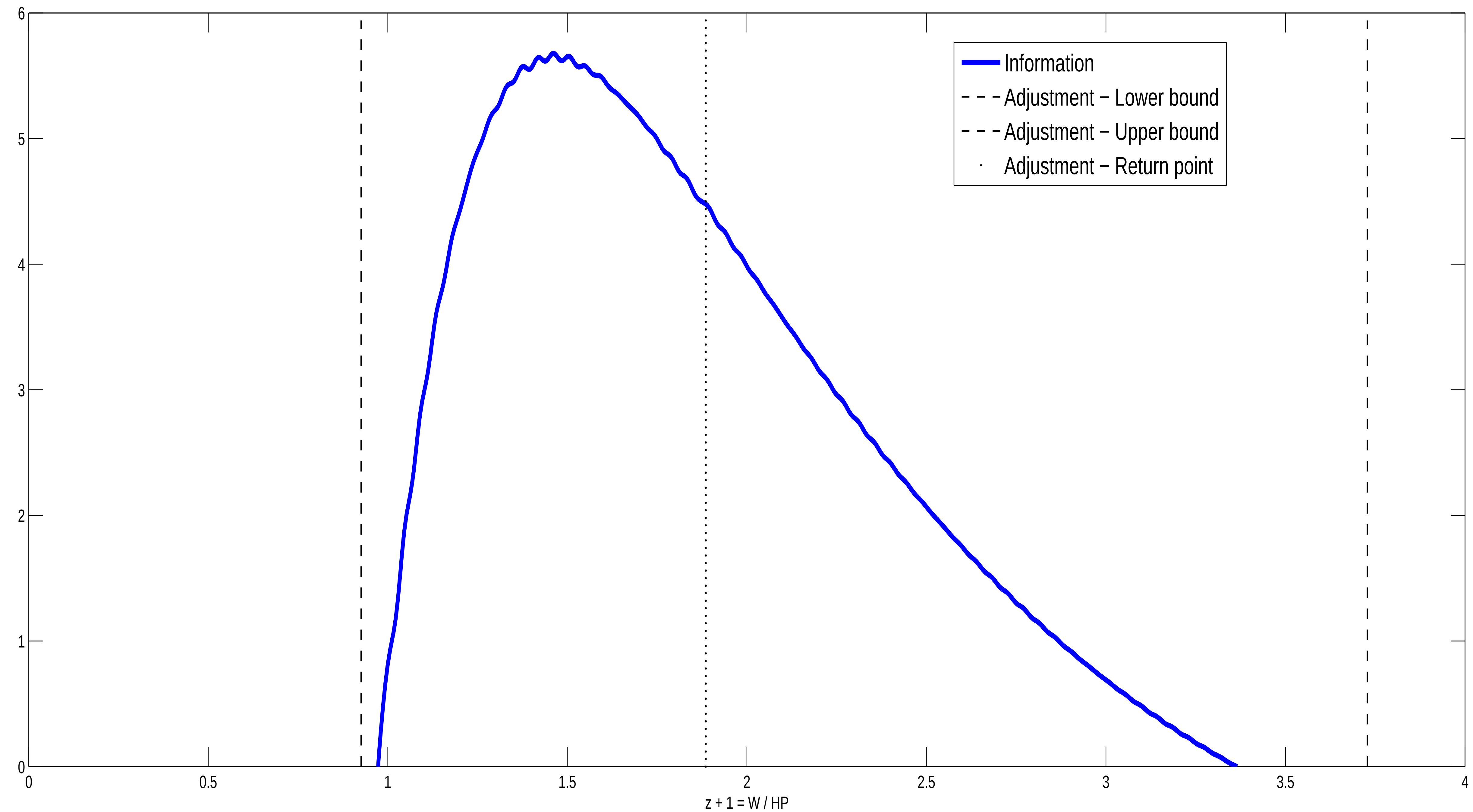
$$b^*(z) = z - \theta^*(z)$$

for the constant ω defined as $\omega = \left[\alpha_S - r + (1-\beta(1-\gamma))\rho_{PS}\sigma_P\right]/\sigma_S^2$.

Baseline Calibration

Variable	Symbol	Value
Curvature of the utility function	γ	2
House flow services	$1-\beta$	0.4
Time preference	ρ	0.025
Risk free rate	r	0.015
Housing stock depreciation	δ	0.02
Transaction cost	ϕ_a	0.06
information cost	ϕ_o	0.06
Risky asset drift	α_S	0.077
Standard deviation risky asset	σ_S	0.1655
Correlation house price - risky asset	ρ_{PS}	0.25
Standard deviation house price	σ_P	0.14
House price drift	μ_P	0.03
Overvaluation	m_H	20%
Undervaluation	m_L	-20%
Probability	π	0.5

Graphical Solution



Sensitivity to Misperception

Table 1: **Acquisition of information, housing adjustments, and misperception.** Model outcomes for the information acquisition boundaries, the housing adjustment boundaries, and the return points under different parameterizations.

	Adjust LB	Info. LB	Return Point	Info. UB	Adjust UB
GL (no misperception)	-0.025		0.955		2.311
Benchmark (+5%/-5%)	-0.074	-0.070	0.885	2.432	2.867
Increase misperception	0.120	0.138	0.773	2.160	2.542
Overvaluation - $\nabla\pi$	0.022	0.023	0.709	4.855	5.111
Undervaluation - $\Delta\pi$	0.127	0.134	0.948	1.807	1.902

- with respect to GL, inaction region is lower and smaller

Sensitivity to Misperception

Table 1: **Acquisition of information, housing adjustments, and misperception.** Model outcomes for the information acquisition boundaries, the housing adjustment boundaries, and the return points under different parameterizations.

	Adjust LB	Info. LB	Return Point	Info. UB	Adjust UB
GL (no misperception)	-0.025		0.955		2.311
Benchmark (+5%/-5%)	-0.074	-0.070	0.885	2.432	2.867
Increase misperception	0.120	0.138	0.773	2.160	2.542
Overvaluation - $\nabla\pi$	0.022	0.023	0.709	4.855	5.111
Undervaluation - $\Delta\pi$	0.127	0.134	0.948	1.807	1.902

- with respect to GL, inaction region is lower and smaller
- wider misperception, lowers inaction region even more

Sensitivity to Misperception

Table 1: **Acquisition of information, housing adjustments, and misperception.** Model outcomes for the information acquisition boundaries, the housing adjustment boundaries, and the return points under different parameterizations.

	Adjust LB	Info. LB	Return Point	Info. UB	Adjust UB
GL (no misperception)	-0.025		0.955		2.311
Benchmark (+5%/-5%)	-0.074	-0.070	0.885	2.432	2.867
Increase misperception	0.120	0.138	0.773	2.160	2.542
Overvaluation - $\nabla\pi$	0.022	0.023	0.709	4.855	5.111
Undervaluation - $\Delta\pi$	0.127	0.134	0.948	1.807	1.902

- with respect to GL, inaction region is lower and smaller
- wider misperception, lowers inaction region even more
- more undervaluation, widens inaction region for information

Sensitivity to Misperception

FEDERAL RESERVE BANK OF BOSTON™

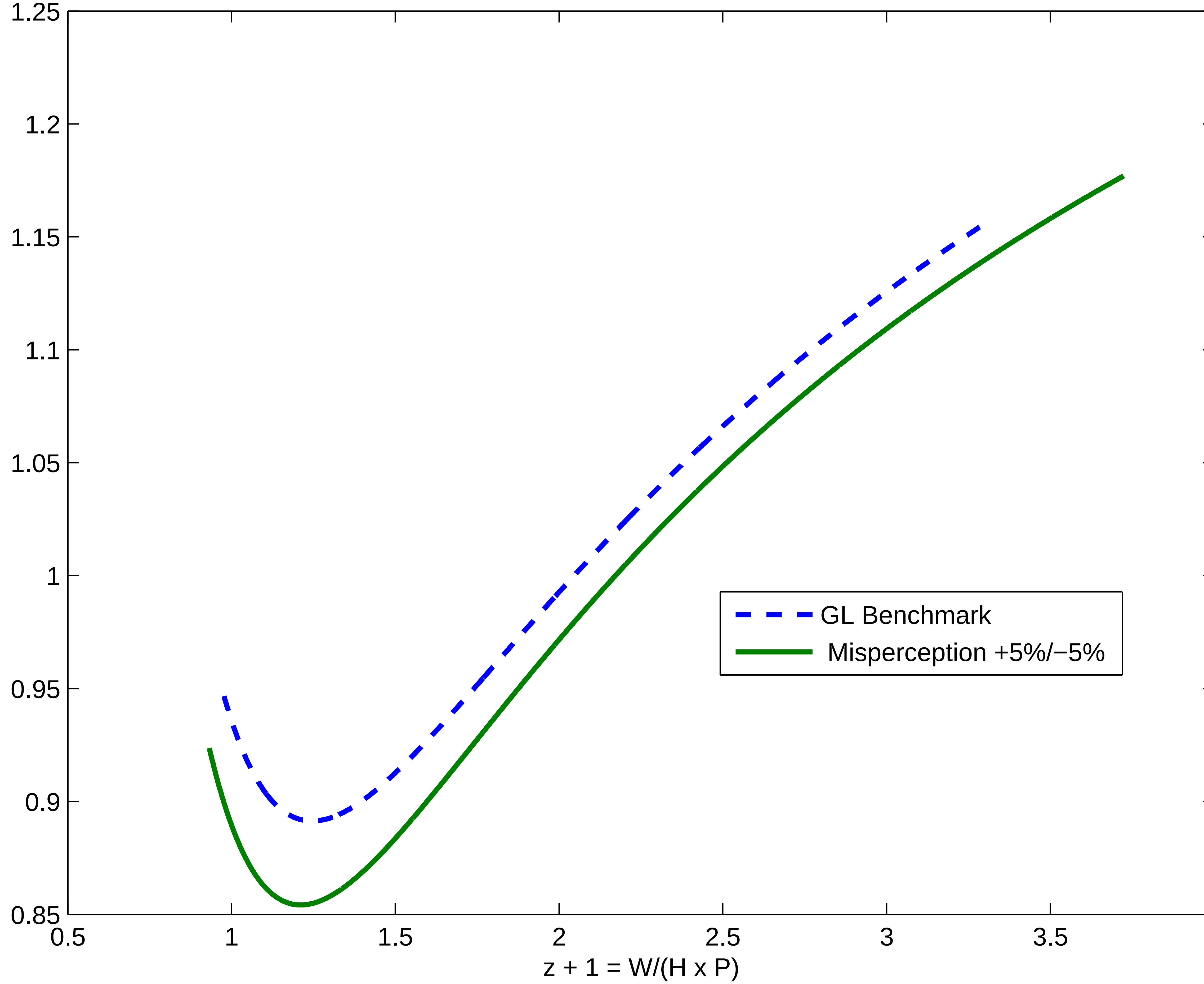
Table 1: **Acquisition of information, housing adjustments, and misperception.** Model outcomes for the information acquisition boundaries, the housing adjustment boundaries, and the return points under different parameterizations.

	Adjust LB	Info. LB	Return Point	Info. UB	Adjust UB
GL (no misperception)	-0.025		0.955		2.311
Benchmark (+5%/-5%)	-0.074	-0.070	0.885	2.432	2.867
Increase misperception	0.120	0.138	0.773	2.160	2.542
Overvaluation - $\nabla\pi$	0.022	0.023	0.709	4.855	5.111
Undervaluation - $\Delta\pi$	0.127	0.134	0.948	1.807	1.902

- with respect to GL, inaction region is lower and smaller
- wider misperception, lowers inaction region even more
- more undervaluation, widens inaction region for information
- more overvaluation, narrows inaction region for information

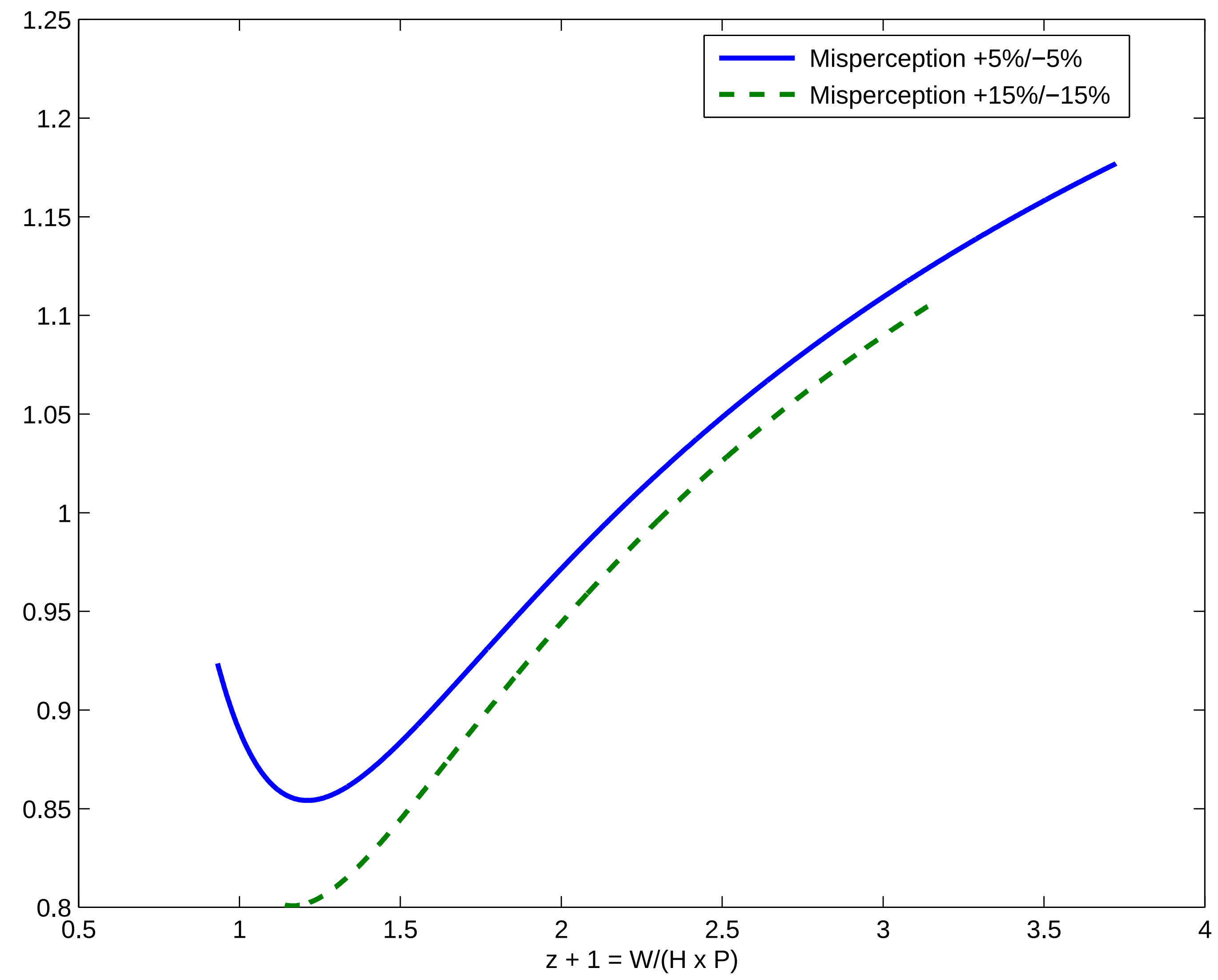
PREDICTIONS AND EMPIRICAL RESULTS

Risky assets and misperception

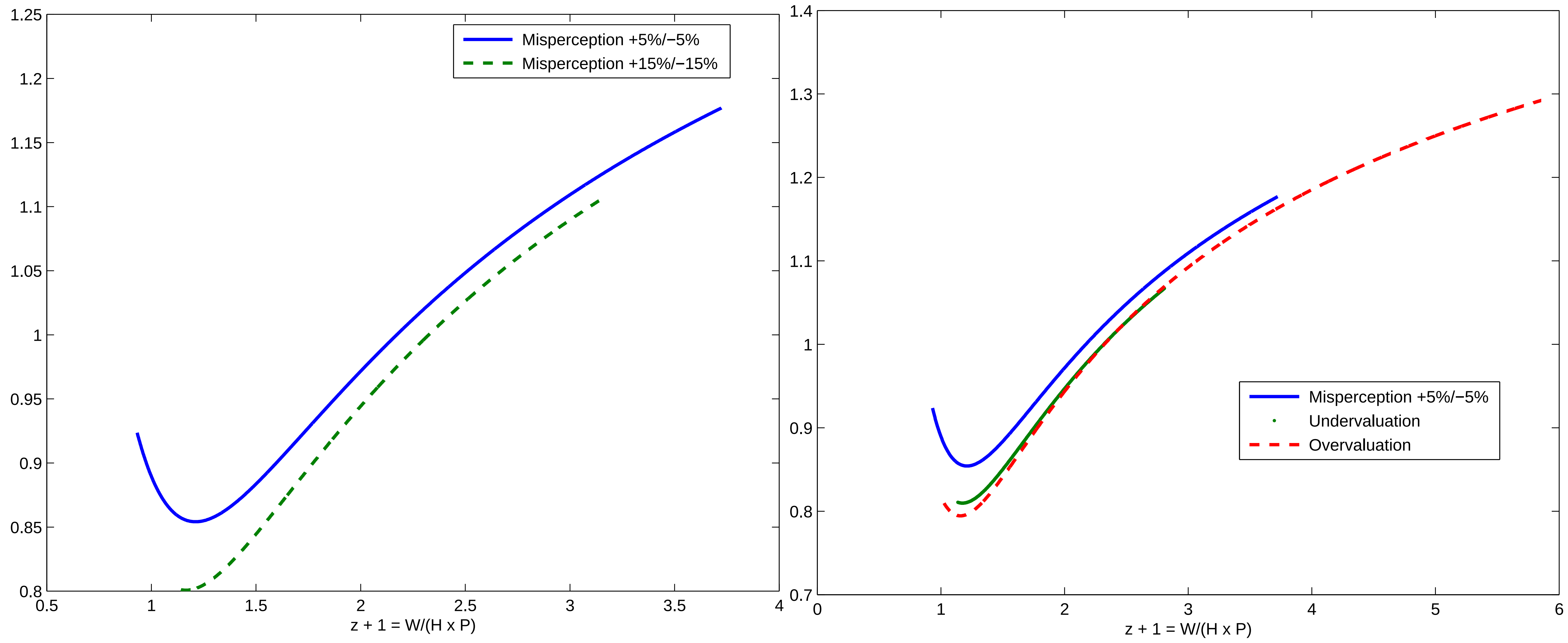


FEDERAL RESERVE BANK OF BOSTON™

Risky assets and probabilities of over/undervaluation



Risky assets and probabilities of over/undervaluation



Misperception and Risky Stock Holdings - Empirics

$$\frac{\theta_{it}}{z_{it}} = \gamma_0 + \gamma_1 \cdot z_{it} + \gamma_2 \cdot m_{it} + \gamma_3 \cdot z_{it} \cdot m_{it} + \Gamma \cdot X_{it} + u_{it}, \quad (1)$$

Panel A: Misperception (dispersion)

	[1]	[2]	[3]
m_{it}	-0.006968^{**}	-0.010731^{***}	-0.010729^{*}
	$[-2.11]$	$[-2.77]$	$[-1.88]$
z_{it}	0.001718^{***}	0.000773^{*}	0.000775
	$[5.10]$	$[1.79]$	$[1.15]$
$m_{it} * z$	0.001859	0.002865^{*}	0.002869
	$[1.43]$	$[1.93]$	$[1.39]$
constant	0.04553	-0.077445	-0.076793
	$[0.1]$	$[-0.51]$	$[-0.33]$
R^2	5.83%	57.36%	57.14%
FE/RE	*RE*	*FE*	*FE*
Cluster	*No*	*No*	*Zip*
Obs.	4,225	4,225	4,198

Misperception and Risky Stock Holdings - Empirics

$$\frac{\theta_{it}}{z_{it}} = \gamma_0 + \gamma_1 \cdot z_{it} + \gamma_2 \cdot m_{it} + \gamma_3 \cdot z_{it} \cdot m_{it} + \Gamma \cdot X_{it} + u_{it}, \quad (1)$$

Panel A: Misperception (dispersion)

	[1]	[2]	[3]
m_{it}	-0.006968^{**}	-0.010731^{***}	-0.010729^{*}
	[−2.11]	[−2.77]	[−1.88]
z_{it}	0.001718^{***}	0.000773^{*}	0.000775
	[5.10]	[1.79]	[1.15]
$m_{it} * z$	0.001859	0.002865^{*}	0.002869
	[1.43]	[1.93]	[1.39]
constant	0.04553	−0.077445	−0.076793
	[0.1]	[−0.51]	[−0.33]
R^2	5.83%	57.36%	57.14%
FE/RE	*RE*	*FE*	*FE*
Cluster	*No*	*No*	*Zip*
Obs.	4,225	4,225	4,198

Misperception and Risky Stock Holdings - Empirics

$$\frac{\theta_{it}}{z_{it}} = \gamma_0 + \gamma_1 \cdot z_{it} + \gamma_2 \cdot m_{it} + \gamma_3 \cdot z_{it} \cdot m_{it} + \Gamma \cdot X_{it} + u_{it}, \quad (1)$$

Panel A: Misperception (dispersion)

	[1]	[2]	[3]
m_{it}	-0.006968^{**}	-0.010731^{***}	-0.010729^{*}
	[−2.11]	[−2.77]	[−1.88]
z_{it}	0.001718^{***}	0.000773^{*}	0.000775
	[5.10]	[1.79]	[1.15]
$m_{it} * z$	0.001859	0.002865^{*}	0.002869
	[1.43]	[1.93]	[1.39]
constant	0.04553	−0.077445	−0.076793
	[0.1]	[−0.51]	[−0.33]
R^2	5.83%	57.36%	57.14%
FE/RE	*RE*	*FE*	*FE*
Cluster	*No*	*No*	*Zip*
Obs.	4,225	4,225	4,198

Panel B: Misperception (overvaluation)

	[1]	[2]	[3]
m_{it}	-0.005282^{**}	-0.007952^{***}	-0.007951^{***}
	[−2.55]	[−3.29]	[−1.99]
z_{it}	0.001893^{***}	0.001120^{***}	0.001122^{*}
	[6.34]	[2.84]	[1.82]
$m_{it} * z$	0.001076	0.002380^{**}	0.002379
	[1.28]	[2.45]	[1.62]
constant	0.063773	−0.034879	−0.034326
	[0.72]	[−0.23]	[−0.15]
R^2	6.09%	57.4%	57.18%
FE/RE	*RE*	*FE*	*FE*
Cluster	*No*	*No*	*Zip*
Obs.	4,225	4,225	4,198

Misperception and Risky Stock Holdings - Empirics

$$\frac{\theta_{it}}{z_{it}} = \gamma_0 + \gamma_1 \cdot z_{it} + \gamma_2 \cdot m_{it} + \gamma_3 \cdot z_{it} \cdot m_{it} + \Gamma \cdot X_{it} + u_{it}, \tag{1}$$

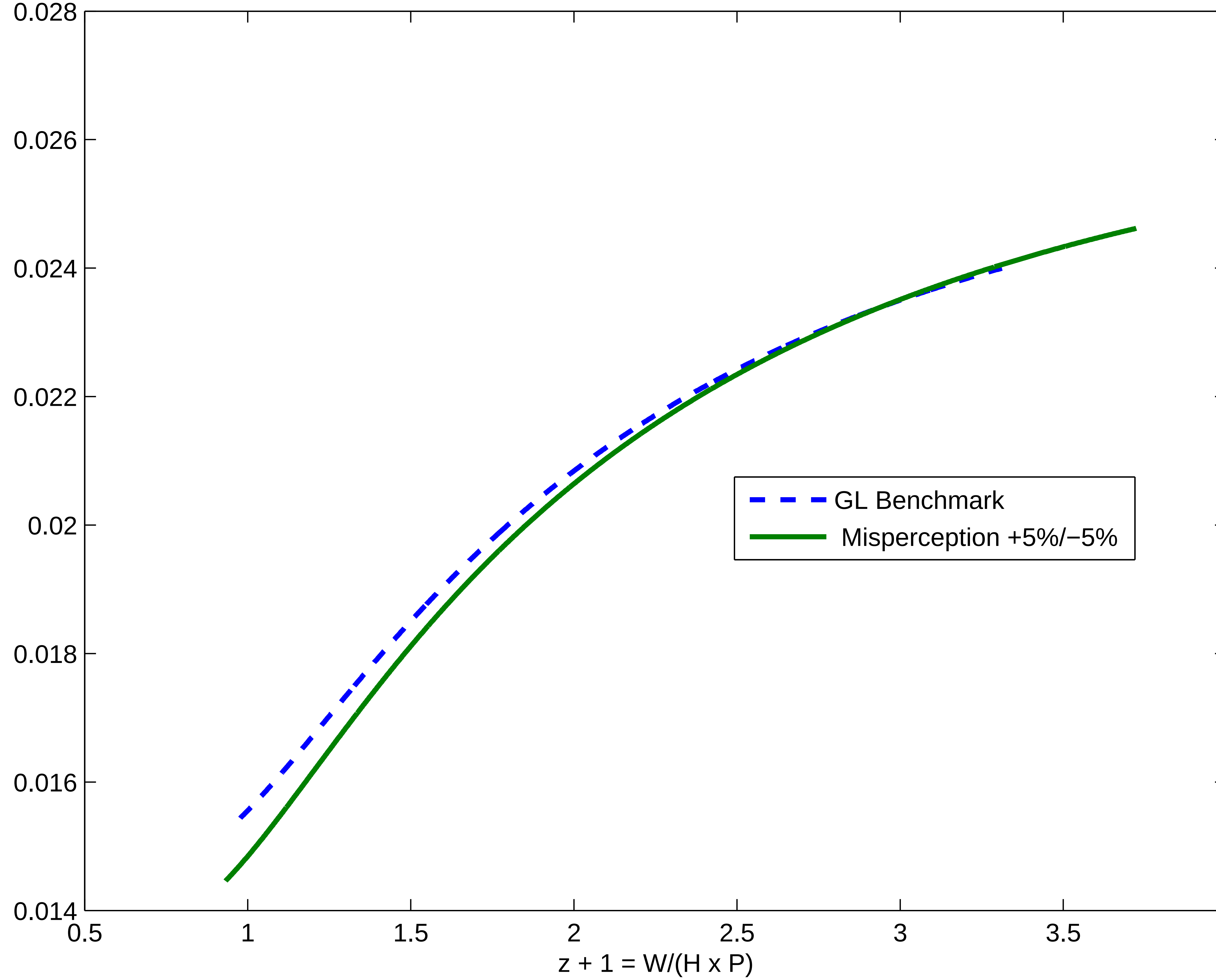
Panel A: Misperception (dispersion)

	[1]	[2]	[3]
m_{it}	-0.006968^{**}	-0.010731^{***}	-0.010729^{*}
	[−2.11]	[−2.77]	[−1.88]
z_{it}	0.001718^{***}	0.000773^{*}	0.000775
	[5.10]	[1.79]	[1.15]
$m_{it} * z$	0.001859	0.002865^{*}	0.002869
	[1.43]	[1.93]	[1.39]
constant	0.04553	−0.077445	−0.076793
	[0.1]	[−0.51]	[−0.33]
R^2	5.83%	57.36%	57.14%
FE/RE	*RE*	*FE*	*FE*
Cluster	*No*	*No*	*Zip*
Obs.	4,225	4,225	4,198

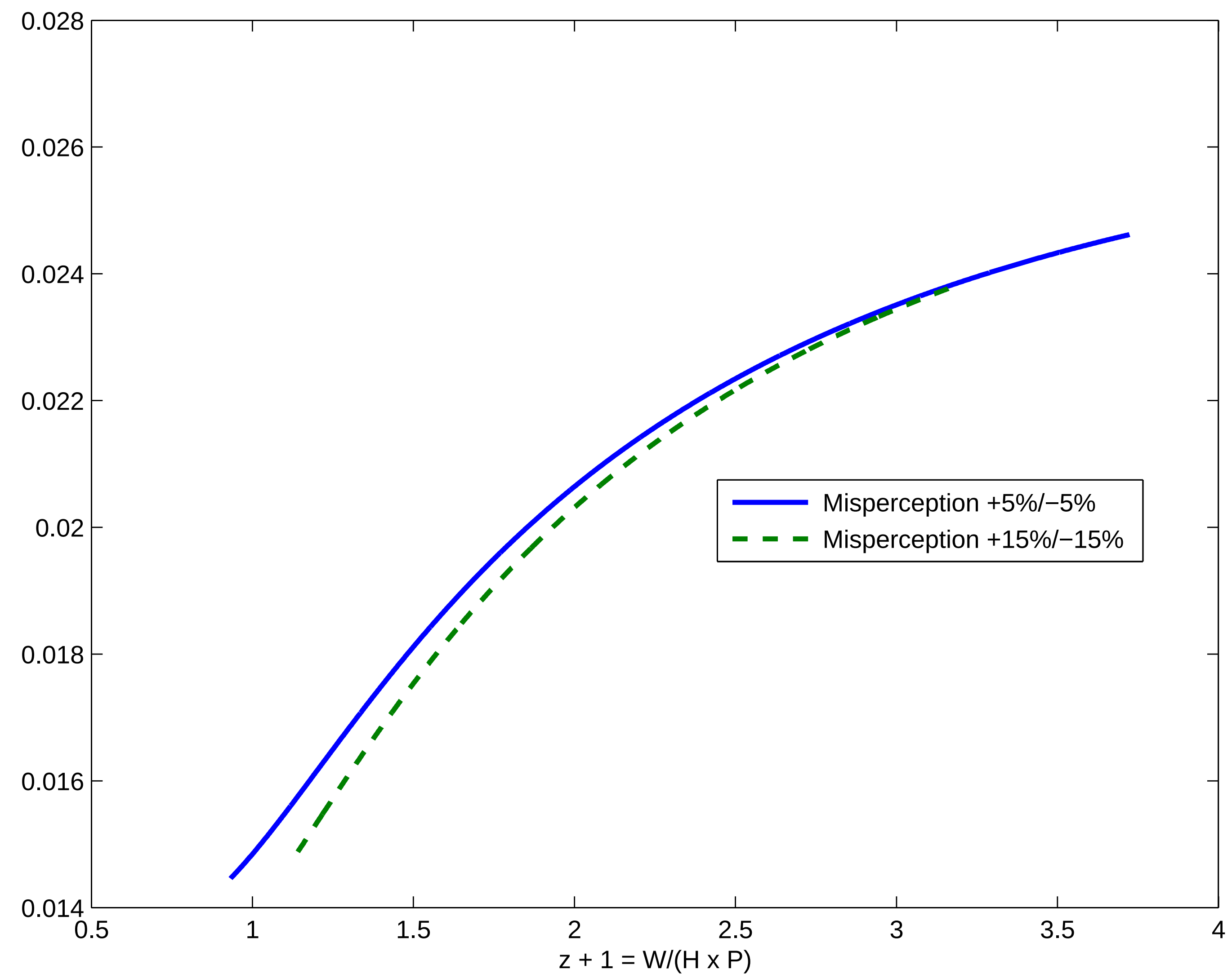
Panel B: Misperception (overvaluation)

	[1]	[2]	[3]
m_{it}	-0.005282^{**}	-0.007952^{***}	-0.007951^{***}
	[−2.55]	[−3.29]	[−1.99]
z_{it}	0.001893^{***}	0.001120^{***}	0.001122^{*}
	[6.34]	[2.84]	[1.82]
$m_{it} * z$	0.001076	0.002380^{**}	0.002379
	[1.28]	[2.45]	[1.62]
constant	0.063773	−0.034879	−0.034326
	[0.72]	[−0.23]	[−0.15]
R^2	6.09%	57.4%	57.18%
FE/RE	*RE*	*FE*	*FE*
Cluster	*No*	*No*	*Zip*
Obs.	4,225	4,225	4,198

Misperception and Consumption

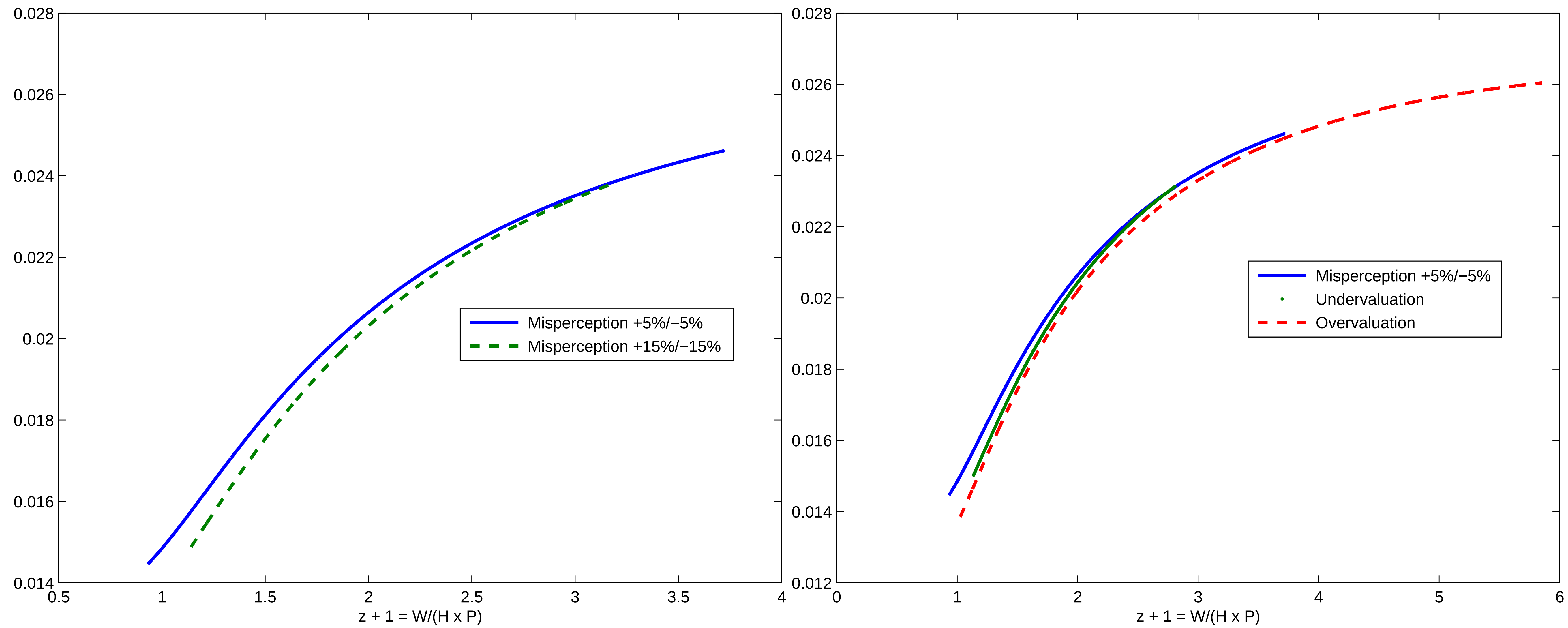


Probabilities of Over/Undervaluation and Consumption



FEDERAL RESERVE BANK OF BOSTON™

Probabilities of Over/Undervaluation and Consumption



Misperception and Consumption - Empirics

$$\frac{C_{it}}{z_{it}} = \gamma_0 + \gamma_1 \cdot z_{it} + \gamma_2 \cdot m_{it} + \gamma_3 \cdot z_{it} \cdot m_{it} + \Gamma \cdot X_{it} + u_{it}, \tag{2}$$

Panel A: Misperception (dispersion)

	[1]	[2]	[3]
m_{it}	-0.008014^{***}	-0.012556^{***}	-0.01260^{***}
	[−2.99]	[−4.45]	[−3.64]
z_{it}	-0.010316^{***}	-0.010356^{***}	-0.010337^{***}
	[−27.55]	[−25.67]	[−17.73]
$m_{it} * z_{it}$	0.003647^{***}	0.003913^{***}	0.003884^{***}
	[3.12]	[3.25]	[3.20]
constant	1.712719^{***}	1.467278^{***}	1.437393^{***}
	[10.62]	[8.08]	[5.26]
R^2	15.15%	81.85%	81.76%
FE/RE	*RE*	*FE*	*FE*
Cluster	*No*	*No*	*Zip*
Obs.	8,192	8,192	8,028

Misperception and Consumption - Empirics

$$\frac{C_{it}}{z_{it}} = \gamma_0 + \gamma_1 \cdot z_{it} + \gamma_2 \cdot m_{it} + \gamma_3 \cdot z_{it} \cdot m_{it} + \Gamma \cdot X_{it} + u_{it}, \tag{2}$$

Panel A: Misperception (dispersion)

	[1]	[2]	[3]
m_{it}	-0.008014^{***}	-0.012556^{***}	-0.01260^{***}
	[−2.99]	[−4.45]	[−3.64]
z_{it}	-0.010316^{***}	-0.010356^{***}	-0.010337^{***}
	[−27.55]	[−25.67]	[−17.73]
$m_{it} * z_{it}$	0.003647^{***}	0.003913^{***}	0.003884^{***}
	[3.12]	[3.25]	[3.20]
constant	1.712719^{***}	1.467278^{***}	1.437393^{***}
	[10.62]	[8.08]	[5.26]
R^2	15.15%	81.85%	81.76%
FE/RE	RE	FE	FE
Cluster	No	No	Zip
Obs.	8,192	8,192	8,028

Misperception and Consumption - Empirics

$$\frac{C_{it}}{z_{it}} = \gamma_0 + \gamma_1 \cdot z_{it} + \gamma_2 \cdot m_{it} + \gamma_3 \cdot z_{it} \cdot m_{it} + \Gamma \cdot X_{it} + u_{it}, \quad (2)$$

Panel A: Misperception (dispersion)

	[1]	[2]	[3]
m_{it}	-0.008014^{***}	-0.012556^{***}	-0.01260^{***}
	[−2.99]	[−4.45]	[−3.64]
z_{it}	-0.010316^{***}	-0.010356^{***}	-0.010337^{***}
	[−27.55]	[−25.67]	[−17.73]
$m_{it} * z_{it}$	0.003647^{***}	0.003913^{***}	0.003884^{***}
	[3.12]	[3.25]	[3.20]
constant	1.712719^{***}	1.467278^{***}	1.437393^{***}
	[10.62]	[8.08]	[5.26]
R^2	15.15%	81.85%	81.76%
FE/RE	*RE*	*FE*	*FE*
Cluster	*No*	*No*	*Zip*
Obs.	8,192	8,192	8,028

Panel B: Misperception (overvaluation)

	[1]	[2]	[3]
m_{it}	-0.024522^{***}	-0.024224^{***}	-0.024275^{***}
	[−15.18]	[−14.29]	[−8.73]
z_{it}	-0.009922^{***}	-0.009890^{***}	-0.009876^{***}
	[−31.03]	[−28.49]	[−19.52]
$m_{it} * z_{it}$	0.003667^{***}	0.004058^{***}	0.004065^{***}
	[5.03]	[5.38]	[4.22]
constant	1.318664^{***}	1.213028^{***}	1.183237^{***}
	[8.40]	[6.88]	[4.40]
R^2	17.90%	82.67%	82.58%
FE/RE	*RE*	*FE*	*FE*
Cluster	*No*	*No*	*Zip*
Obs.	8,192	8,192	8,028

Misperception and Consumption - Empirics

$$\frac{C_{it}}{z_{it}} = \gamma_0 + \gamma_1 \cdot z_{it} + \gamma_2 \cdot m_{it} + \gamma_3 \cdot z_{it} \cdot m_{it} + \Gamma \cdot X_{it} + u_{it}, \qquad (2)$$

Panel A: Misperception (dispersion)

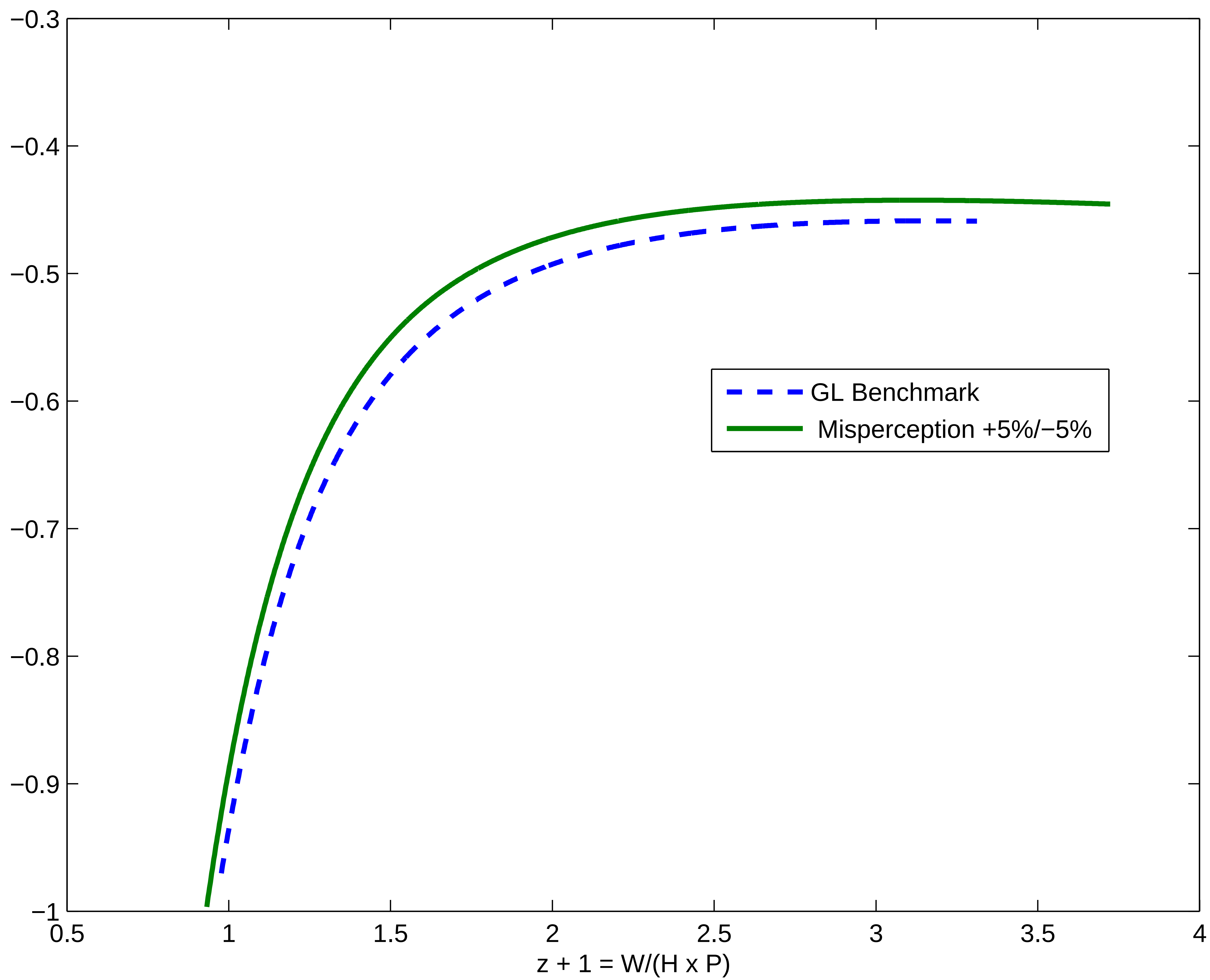
	[1]	[2]	[3]
m_{it}	-0.008014^{***}	-0.012556^{***}	-0.01260^{***}
	$[-2.99]$	$[-4.45]$	$[-3.64]$
z_{it}	-0.010316^{***}	-0.010356^{***}	-0.010337^{***}
	$[-27.55]$	$[-25.67]$	$[-17.73]$
$m_{it} * z_{it}$	0.003647^{***}	0.003913^{***}	0.003884^{***}
	$[3.12]$	$[3.25]$	$[3.20]$
constant	1.712719^{***}	1.467278^{***}	1.437393^{***}
	$[10.62]$	$[8.08]$	$[5.26]$
R^2	15.15%	81.85%	81.76%
FE/RE	*RE*	*FE*	*FE*
Cluster	*No*	*No*	*Zip*
Obs.	8,192	8,192	8,028

Panel B: Misperception (overvaluation)

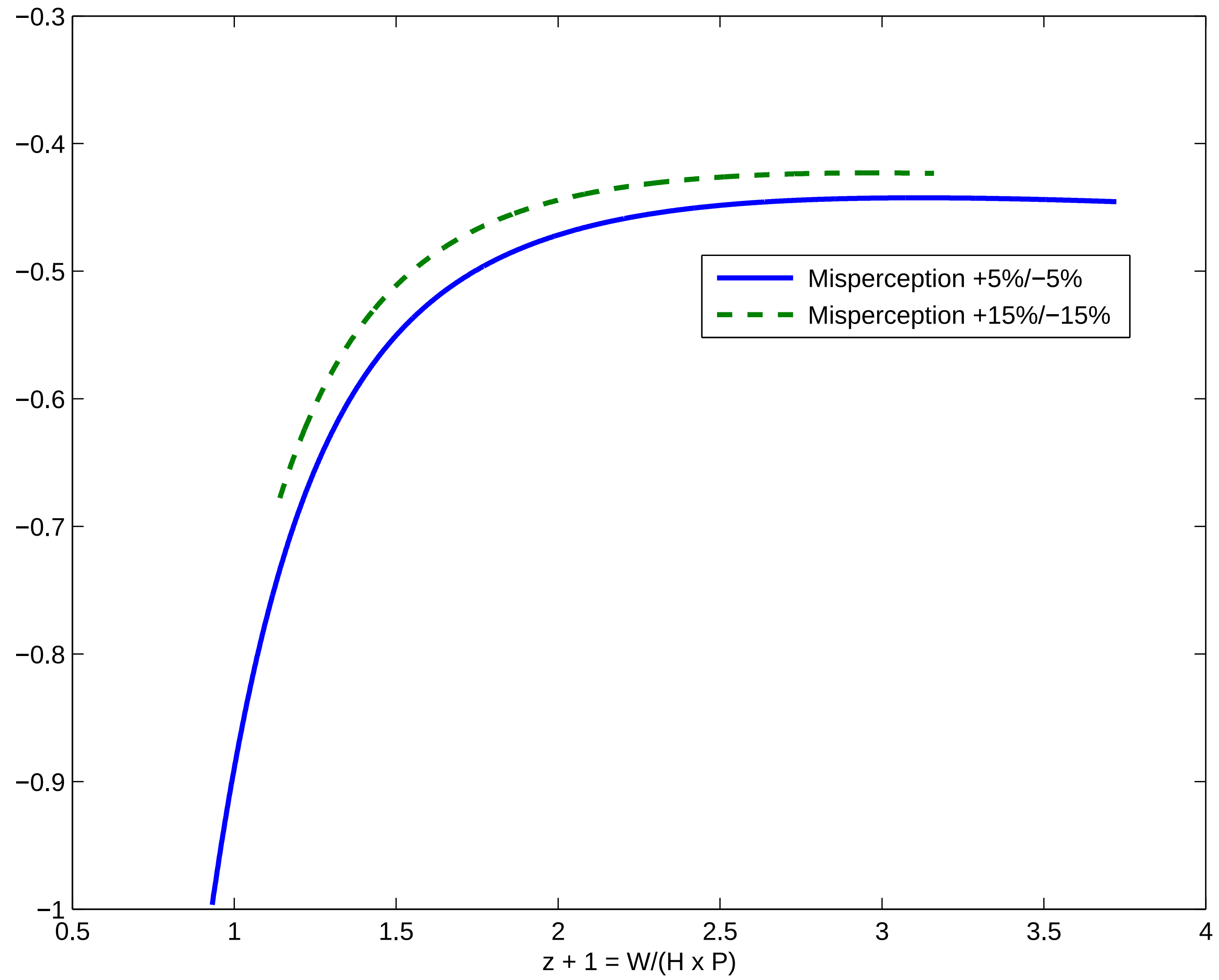
	[1]	[2]	[3]
m_{it}	-0.024522^{***}	-0.024224^{***}	-0.024275^{***}
	$[-15.18]$	$[-14.29]$	$[-8.73]$
z_{it}	-0.009922^{***}	-0.009890^{***}	-0.009876^{***}
	$[-31.03]$	$[-28.49]$	$[-19.52]$
$m_{it} * z_{it}$	0.003667^{***}	0.004058^{***}	0.004065^{***}
	$[5.03]$	$[5.38]$	$[4.22]$
constant	1.318664^{***}	1.213028^{***}	1.183237^{***}
	$[8.40]$	$[6.88]$	$[4.40]$
R^2	17.90%	82.67%	82.58%
FE/RE	*RE*	*FE*	*FE*
Cluster	*No*	*No*	*Zip*
Obs.	8,192	8,192	8,028

FEDERAL RESERVE BANK OF BOSTON™

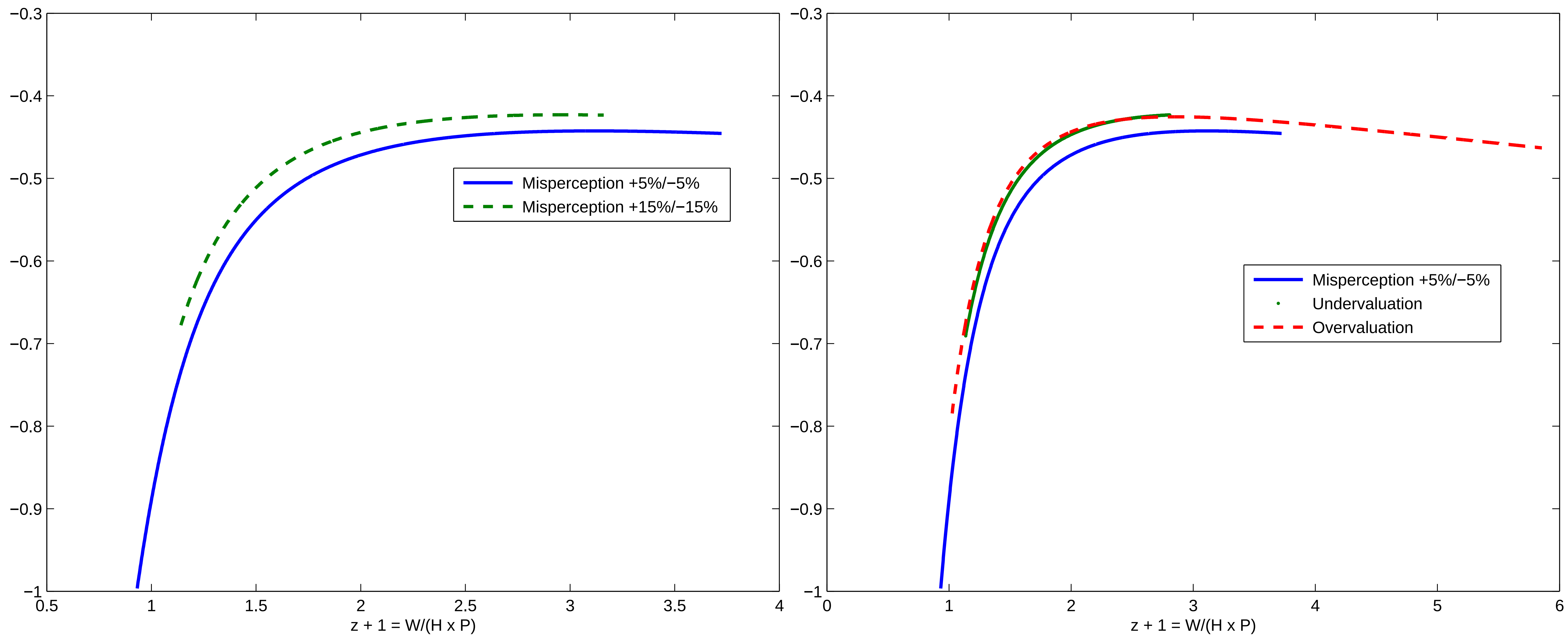
Misperception and Leverage



Probabilities of Over/Undervaluation and leverage



Probabilities of Over/Undervaluation and leverage



Misperception and Leverage - Empirics

$$\frac{B_{it}}{z_{it}} = \gamma_0 + \gamma_1 \cdot z_{it} + \gamma_2 \cdot m_{it} + \gamma_3 \cdot z_{it} \cdot m_{it} + \Gamma \cdot X_{it} + u_{it}, \tag{3}$$

Panel A: Misperception (dispersion)

	[1]	[2]	[3]
m_{it}	-0.139381^{***}	-0.170331^{***}	-0.171242^{***}
	[−7.11]	[−6.92]	[−3.90]
z	-0.039793^{***}	-0.051349^{***}	-0.051589^{***}
	[−14.24]	[−13.98]	[−9.14]
$m_{it} * z$	0.084761^{***}	0.098550^{***}	0.099200^{***}
	[7.91]	[7.70]	[4.03]
constant	1.894726^{***}	1.549514	1.383134
	[2.78]	[1.57]	[0.85]
R^2	6.93%	71.16%	71.01%
FE/RE	RE	FE	FE
Cluster	No	No	Zip
Obs.	3,828	3,828	3,857

Misperception and Leverage - Empirics

$$\frac{B_{it}}{z_{it}} = \gamma_0 + \gamma_1 \cdot z_{it} + \gamma_2 \cdot m_{it} + \gamma_3 \cdot z_{it} \cdot m_{it} + \Gamma \cdot X_{it} + u_{it}, \quad (3)$$

Panel A: Misperception (dispersion)

	[1]	[2]	[3]
m_{it}	-0.139381^{***}	-0.170331^{***}	-0.171242^{***}
	[−7.11]	[−6.92]	[−3.90]
z	-0.039793^{***}	-0.051349^{***}	-0.051589^{***}
	[−14.24]	[−13.98]	[−9.14]
$m_{it} * z$	0.084761^{***}	0.098550^{***}	0.099200^{***}
	[7.91]	[7.70]	[4.03]
constant	1.894726^{***}	1.549514	1.383134
	[2.78]	[1.57]	[0.85]
R^2	6.93%	71.16%	71.01%
FE/RE	RE	FE	FE
Cluster	No	No	Zip
Obs.	3,828	3,828	3,857

Misperception and Leverage - Empirics

$$\frac{B_{it}}{z_{it}} = \gamma_0 + \gamma_1 \cdot z_{it} + \gamma_2 \cdot m_{it} + \gamma_3 \cdot z_{it} \cdot m_{it} + \Gamma \cdot X_{it} + u_{it}, \quad (3)$$

Panel A: Misperception (dispersion)

	[1]	[2]	[3]
m_{it}	-0.139381^{***}	-0.170331^{***}	-0.171242^{***}
	[−7.11]	[−6.92]	[−3.90]
z	-0.039793^{***}	-0.051349^{***}	-0.051589^{***}
	[−14.24]	[−13.98]	[−9.14]
$m_{it} * z$	0.084761^{***}	0.098550^{***}	0.099200^{***}
	[7.91]	[7.70]	[4.03]
constant	1.894726^{***}	1.549514	1.383134
	[2.78]	[1.57]	[0.85]
R^2	6.93%	71.16%	71.01%
FE/RE	*RE*	*FE*	*FE*
Cluster	*No*	*No*	*Zip*
Obs.	3,828	3,828	3,857

Panel B: Misperception (overvaluation)

	[1]	[2]	[3]
m_{it}	0.006325	−0.009512	−0.008998
	[0.46]	[−0.54]	[−0.31]
z	-0.030290^{***}	-0.037645^{***}	-0.037771^{***}
	[−12.81]	[−12.14]	[−6.05]
$m_{it} * z$	-0.038122^{***}	-0.025783^{**}	−0.026115
	[−4.47]	[−2.41]	[−1.44]
constant	1.817843^{***}	1.696728^{*}	1.517266
	[2.70]	[1.71]	[0.90]
R^2	7.52%	70.68%	70.51%
FE/RE	*RE*	*FE*	*FE*
Cluster	*No*	*No*	*Zip*
Obs.	3,828	3,828	3,857

CONCLUSION

Conclusions

- House price misperception affects the optimal behavior of households (via risk aversion). The more misperception,
  - less investment in risky assets
  - larger housing wealth relative to total wealth
  - acquire information more frequently
- Overvaluation ⇒ less risky asset near downsizing
- Overvaluation ⇒ narrower bands of inaction

In this paper

- Showed evidence of misperception
- Build misperception into a portfolio choice model
- Tested implications with household level data (PSID)

Next Steps

On the model:

- Extend to a richer model for misperception as a function of tenure (to match data)

On the empirical implications:

- Extend the analysis to include tenure.
- Robustness: Census Data.
- Better understanding of the drivers behind misperception and implication on other markets.

APPENDIX

FEDERAL RESERVE BANK OF BOSTON™

Solution: Inaction Region

$v(z)$ satisfies

$$\widetilde{\rho} v(z) = \sup_{c,\theta} \left\{ u(c) + \mathcal{D} v(z) \right\}, \quad z \in (\underline{z}_o, \overline{z}_o),$$

Solution: Inaction Region

$v(z)$ satisfies

$$\widetilde{\rho} v(z) = \sup_{c,\theta} \{u(c) + \mathcal{D}v(z)\}, \quad z \in (\underline{z}_o, \overline{z}_o),$$

where

$$\begin{aligned} \mathcal{D}v(z) =& (z(r + \delta - \mu_P + \sigma_P^2(1 + \beta(\gamma - 1))) \\ &+ \theta(\alpha_S - r - (1 + \beta(\gamma - 1))\rho_{PS}\ \sigma_S \sigma_P) - c) v_z(z) \\ &+ \frac{1}{2}(z^2 \sigma_P^2 - 2z\hat{\theta}\ \rho_{PS}\ \sigma_P \sigma_S + \theta^2 \sigma_S^2) v_{zz}(z), \end{aligned}$$

Solution: Inaction Region

FEDERAL RESERVE BANK OF BOSTON™

$v(z)$ satisfies

$$\widetilde{\rho} v(z) = \sup_{c,\theta} \left\{ u(c) + \mathcal{D}v(z) \right\}, \quad z \in (\underline{z}_o, \overline{z}_o),$$

where

$$\begin{aligned}\mathcal{D}v(z) =& (z(r + \delta - \mu_P + \sigma_P^2(1 + \beta(\gamma - 1))) \\ & + \theta(\alpha_S - r - (1 + \beta(\gamma - 1))\rho_{PS}\ \sigma_S \sigma_P) - c) v_z(z) \\ & + \frac{1}{2}(z^2 \sigma_P^2 - 2z\hat{\theta}\ \rho_{PS}\ \sigma_P \sigma_S + \theta^2 \sigma_S^2) v_{zz}(z),\end{aligned}$$

$$v(z) = M \frac{(z + 1 - \phi_o)^{(1-\gamma)}}{1 - \gamma}, \quad z \notin (\underline{z}_o, \overline{z}_o)$$

Solution: Inaction Region

$v(z)$ satisfies

$$\widetilde{\rho} v(z) = \sup_{c,\theta} \{u(c) + \mathcal{D}v(z)\}, \quad z \in (\underline{z}_o, \overline{z}_o),$$

where

$$\begin{aligned}\mathcal{D}v(z) =& (z(r + \delta - \mu_P + \sigma_P^2(1 + \beta(\gamma - 1))) \\ &+ \theta(\alpha_S - r - (1 + \beta(\gamma - 1))\rho_{PS}\ \sigma_S\sigma_P) - c)v_z(z) \\ &+ \frac{1}{2}(z^2\sigma_P^2 - 2z\hat{\theta}\ \rho_{PS}\ \sigma_P\sigma_S + \theta^2\sigma_S^2)v_{zz}(z),\end{aligned}$$

$$v(z) = M\frac{(z + 1 - \phi_o)^{(1-\gamma)}}{1 - \gamma}, \quad z \notin (\underline{z}_o, \overline{z}_o)$$

$$\widetilde{v}(z) = \widetilde{M}\frac{(z + 1 - \phi_a - \phi_0)^{(1-\gamma)}}{1 - \gamma}, \quad z \notin (\underline{z}_a, \overline{z}_a)$$

Solution: Inaction Region

$v(z)$ satisfies

$$\widetilde{\rho}v(z) = \sup_{c,\theta} \{u(c) + \mathcal{D}v(z)\}, \quad z \in (\underline{z}_o, \overline{z}_o),$$

where

$$\begin{aligned}\mathcal{D}v(z) =&(z(r + \delta - \mu_P + \sigma_P^2(1 + \beta(\gamma - 1))) \\ &+ \theta(\alpha_S - r - (1 + \beta(\gamma - 1))\rho_{PS}\ \sigma_S\sigma_P) - c)v_z(z) \\ &+ \frac{1}{2}(z^2\sigma_P^2 - 2z\hat{\theta}\ \rho_{PS}\ \sigma_P\sigma_S + \theta^2\sigma_S^2)v_{zz}(z),\end{aligned}$$

$$v(z) = M\frac{(z + 1 - \phi_o)^{(1-\gamma)}}{1 - \gamma}, \quad z \notin (\underline{z}_o, \overline{z}_o)$$

$$\widetilde{v}(z) = \widetilde{M}\frac{(z + 1 - \phi_a - \phi_0)^{(1-\gamma)}}{1 - \gamma}, \quad z \notin (\underline{z}_a, \overline{z}_a)$$

and $\widetilde{M}$ is defined as

$$\widetilde{M} = (1 - \gamma)\sup_{z \geq \epsilon}(z + 1)^{\gamma-1}\widetilde{v}(z),$$

FEDERAL RESERVE BANK OF BOSTON™

Solution: Return Point

The return point z_a^* attains the maximum in

$$\widetilde{v}(z^*) = \widetilde{M}\frac{(z_a+1)^{*(1-\gamma)}}{1-\gamma}.$$

Solution: Information Acquisition and Transaction Boundaries

Value matching and smooth pasting conditions hold at the two thresholds $(\underline{z}_a, \overline{z}_a)$

$$\widetilde{v}(z) = \widetilde{M}\frac{(\hat{z} + 1 - \phi_a - \phi_o)^{(1-\gamma)}}{1-\gamma}$$

$$\widetilde{v}_z(z) = \widetilde{M}(\hat{z} - \phi_a - \phi_o)^{-\gamma}$$

Solution: Information Acquisition and Transaction Boundaries

Value matching and smooth pasting conditions hold at the two thresholds $(\underline{z}_a, \overline{z}_a)$

$$\widetilde{v}(z) = \widetilde{M}\frac{(\hat{z}+1-\phi_a-\phi_o)^{(1-\gamma)}}{1-\gamma}$$
$$\widetilde{v}_z(z) = \widetilde{M}(\hat{z}-\phi_a-\phi_o)^{-\gamma}$$

for $\hat{z}_a = \underline{z}_a, \overline{z}_a$ and at the two thresholds $(\underline{z}_o, \overline{z}_o)$

$$v(z) = \pi v\left(\frac{\overline{z}_o}{1+m^h}+1-\phi_o\right)+(1-\pi)M\frac{(\overline{z}_a+1-\phi_a-\phi_o)^{(1-\gamma)}}{1-\gamma},$$
$$v(z) = (1-\pi)v\left(\frac{\underline{z}_o}{1+m^l}+1-\phi_o\right)+\pi M\frac{(\underline{z}_a+1-\phi_a-\phi_o)^{(1-\gamma)}}{1-\gamma} \quad if \quad z>0,$$
$$v(z) = \pi v\left(\frac{\underline{z}_o}{1+m^h}+1-\phi_o\right)+(1-\pi)M\frac{(\underline{z}_a+1-\phi_a-\phi_o)^{(1-\gamma)}}{1-\gamma} \quad if \quad z\leq 0,$$