Macroeconomics of Financial Markets

Some Relation with Empirical Evidence

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October 26, 2018

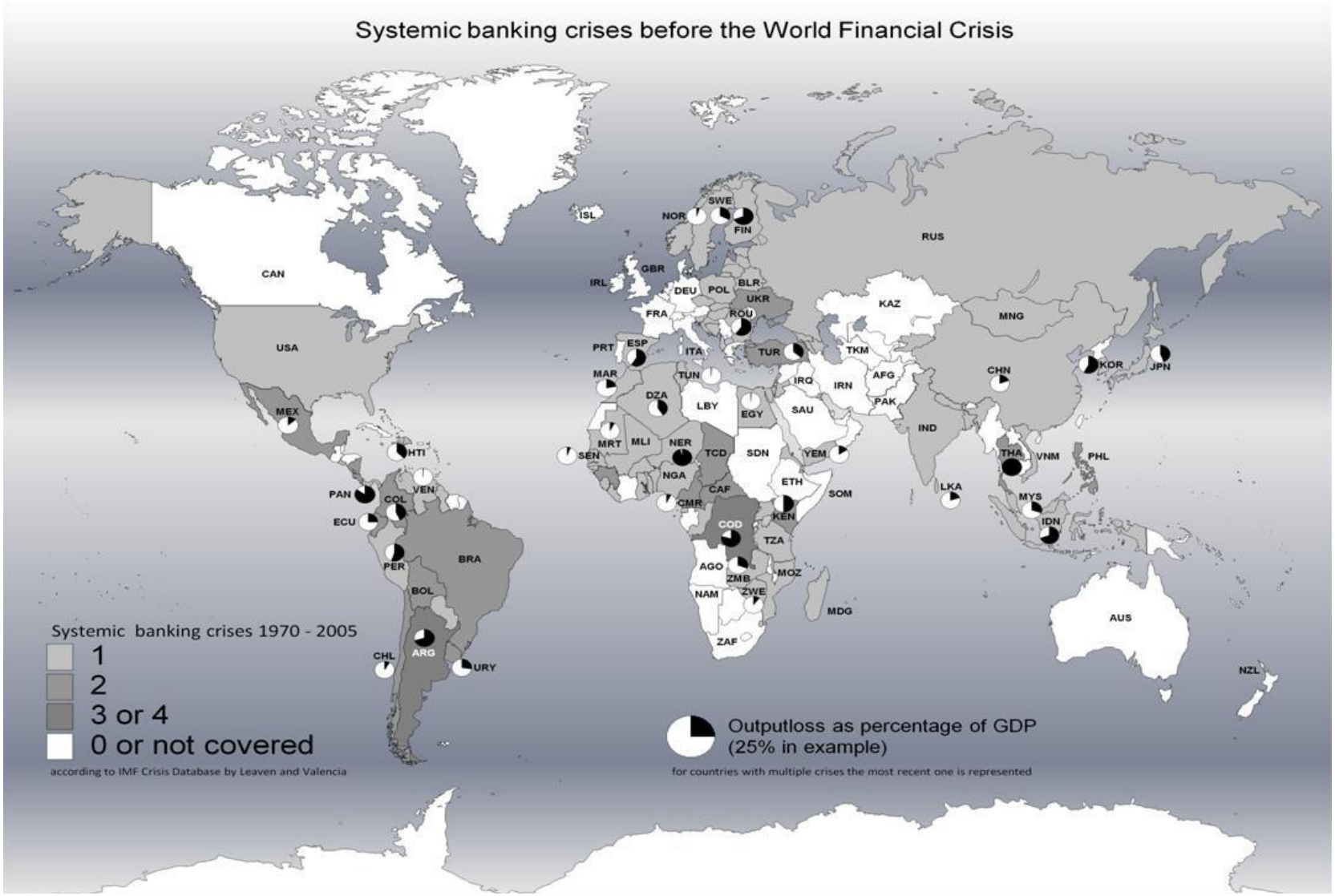
Crises are Common

- Just since 1970, about 147 financial crises around the world.
  - Not just events from the past.
  - Not just in emerging markets.
- Around 75% of all these crises involved a banking crisis.

Crises in Developed Economies

Country	**Financial Crisis (first year)**
Australia	1893, 1989
Canada	1873, 1906, 1923, 1983
Denmark	1877, 1885, 1902, 1907, 1921, 1931, 1987
France	1882, 1889, 1904, 1930, 2008
Germany	1880, 1891, 1901, 1931, 2008
Italy	1887, 1891, 1901, 1930, 1931, 1935, 1990, 2008
Japan	1882, 1907, 1927, 1992
Netherlands	1897, 1921, 1931, 1988
Norway	1899, 1921, 1931, 1988
Spain	1920, 1924, 1931, 1978, 2008
Sweden	1876, 1897, 1907, 1922, 1931, 1991, 2008
Switzerland	1870, 1910, 1931, 2008,
UK	1890, 1974, 1984, 1991, 2007
United States	1873, 1884, 1893, 1907, 1929, 1984, 2007

Banking Crises Around the World



Source: Laeven and Valencia (2012)

Crises Follow Patterns

- Credit booms precede banking crises.

- Schularick and Taylor (AER, 2012).

  14 developed countries, 1870-2008.

$$Logit[Crisis_{j,t}] = \alpha + \beta\ \Delta Credit_{j,[t,t-5]} + \Gamma Controls_{j,t} + e_{j,t}$$

$$0.021^{***}$$

Not Any Credit Boom Precedes a Crisis!

- Credit booms that are characterized by high productivity growth are less likely to end in a banking crisis.

- Gorton and Ordonez (NBER WP, 2016).

  34 countries (18 EMEs), 1960-2015.

$$Logit[Crisis_{j,t}] = \alpha + \beta\ \Delta Credit_{j,[t,t-5]} + \gamma\ \Delta Prod_{j,[t,t-5]} + \Gamma Controls_{j,t} + e_{j,t}$$

LP	$\rightarrow$	0.012^{**}	-0.017^{**}
TFP	$\rightarrow$	0.015^{**}	-0.018^{**}

Not Any Credit Boom Precedes a Crisis!

- Credit booms that are characterized by high popularity growth are more likely to end in crisis.

- Herrera, Ordonez and Trebesch (NBER WP, 2014).

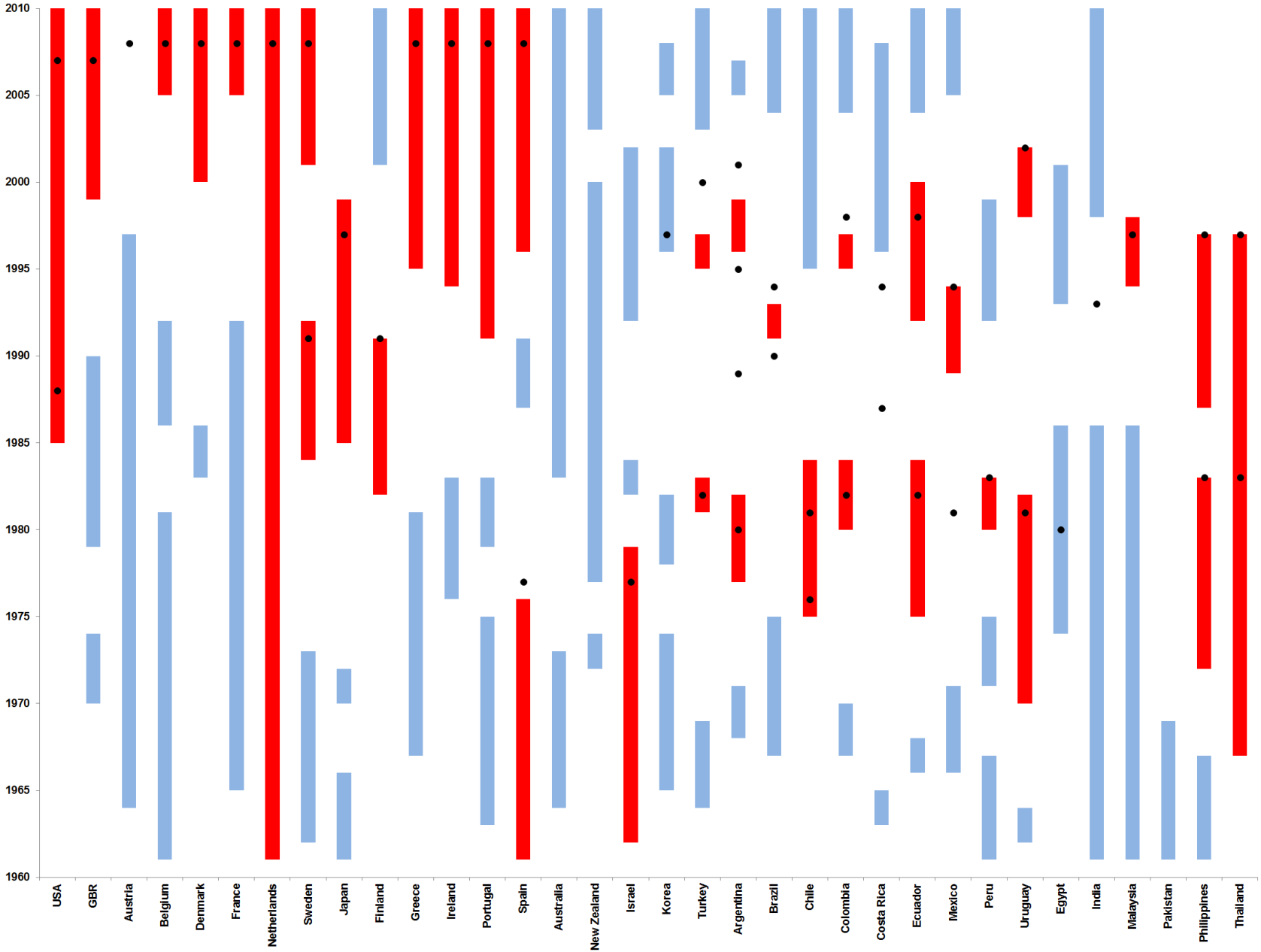
  60 countries (40 EMEs), 1984-2010.

$$Logit[Crisis_{j,t}] = \alpha + \beta\ \Delta Credit_{j,[t,t-5]} + \gamma\ \Delta Pop_{j,[t,t-5]} + \Gamma Controls_{j,t} + e_{j,t}$$

All	$\rightarrow$	0.012^{**}	0.000
EME	$\rightarrow$	0.012^{**}	0.021^{**}

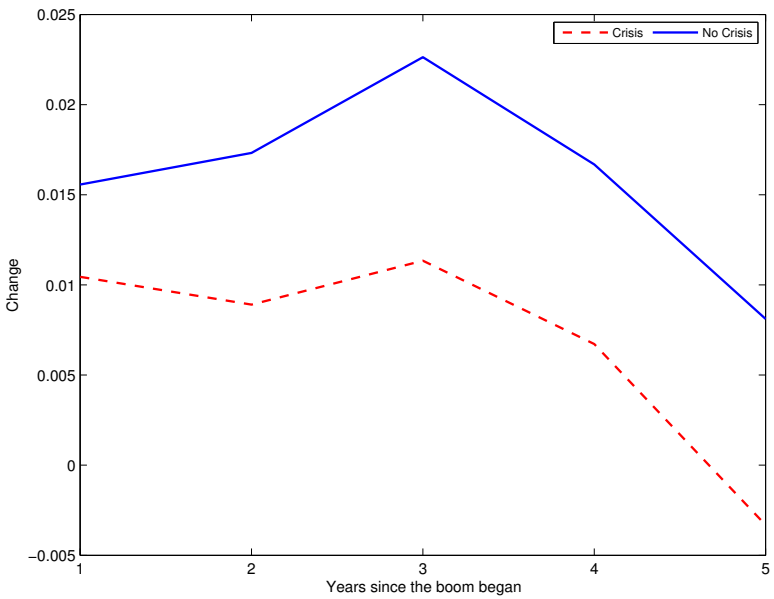
"Good Booms, Bad Booms" in more detail.

Identifying Booms

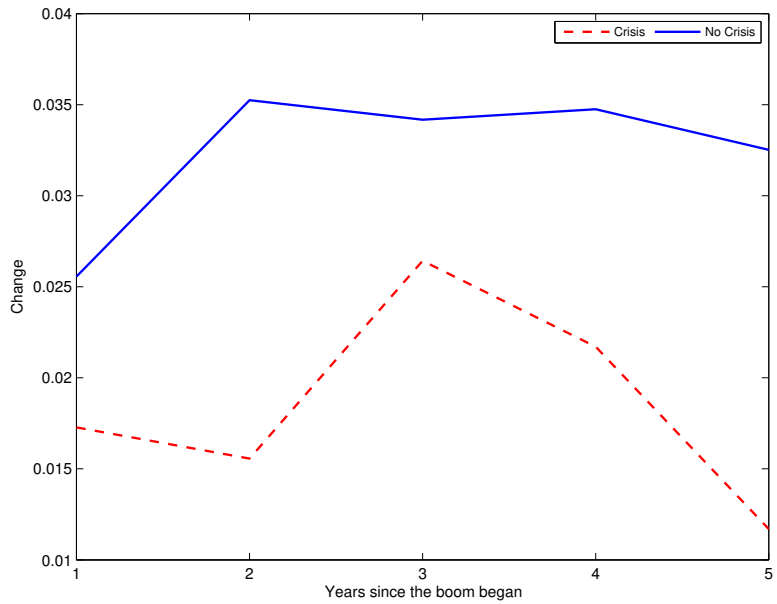


Empirical Findings

- Productivity evolves differently in good booms and in bad booms.



(a) Total Factor Productivity



(b) Labor Productivity

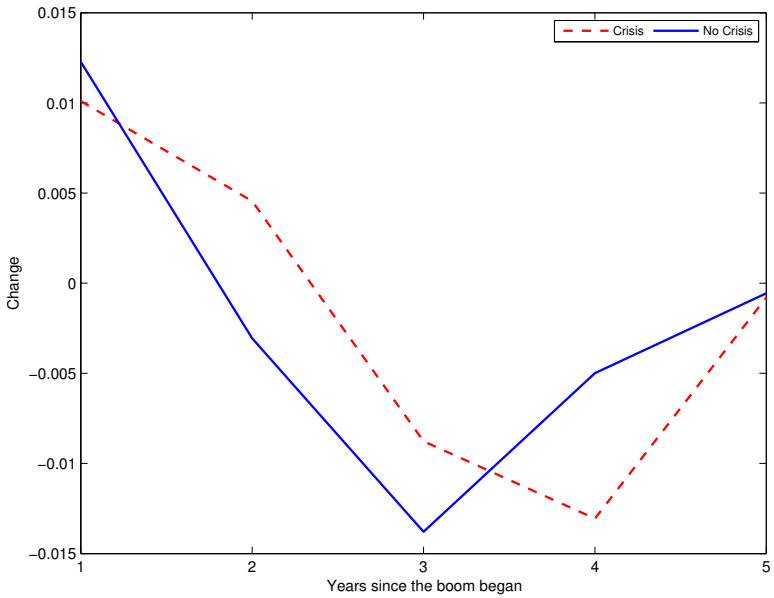
Empirical Findings

- H-P filtering misses all this.

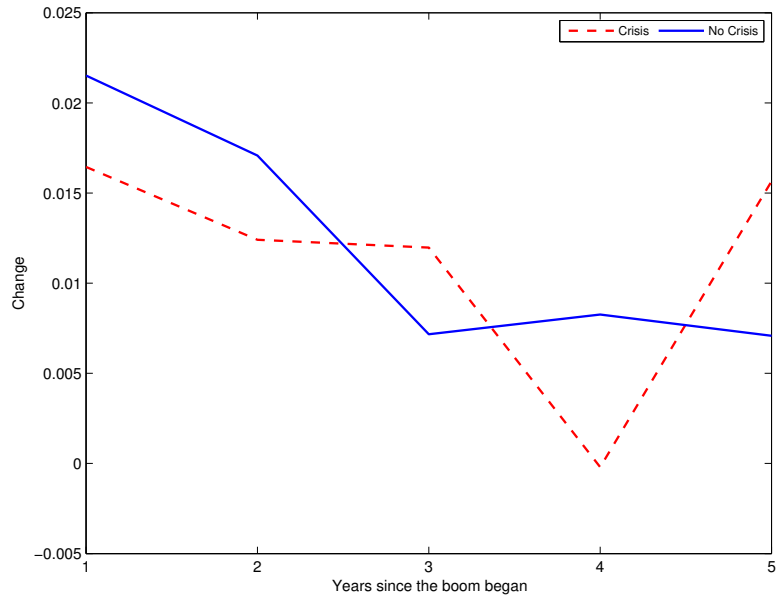
	Number	As a ratio of HP booms
HP boom-years in GO	161	0.80
HP booms included in GO	40	0.91
HP booms	44	1.00
HP booms included in GO starting		
- in the same year	2	0.05
- a year later	6	0.15
- two years later	3	0.07
- three years later	4	0.10
- more than three later	25	0.63

Empirical Findings

- H-P filtering misses all this.



(a) Total Factor Productivity



(b) Labor Productivity

Empirical Findings

- Low productivity growth is correlated with bad booms.

$$Pr(BadBoom_{j,t}|Boom_{j,t}) = Logit(\alpha + \beta \Delta Prod_{j,t})$$

$$\text{LP} \quad \rightarrow \quad -0.08^{***}$$

$$\text{TFP} \quad \rightarrow \quad -0.06^{***}$$

- Credit growth predicts crises, but mitigated by productivity.

$$Pr(Crisis_{j,t}) = Logit(\alpha + \beta \Delta Credit_{j,t-1} + \gamma \Delta Prod_{j,t-1})$$

$$\text{LP} \quad \rightarrow \quad 0.012^{**} \qquad\qquad -0.017^{**}$$

$$\text{TFP} \quad \rightarrow \quad 0.015^{**} \qquad\qquad -0.018^{**}$$

Model

- Single Period (for now).
- Households (mass 1): $\overline{K} > K^*$.
- Firms (mass 1): L^* (no disutility)

$$K_i' = \begin{cases} A \min\{K_i, L_i\} & \texttt{with prob. } q_i \\ 0 & \texttt{otherwise} \end{cases}$$

  Denote the mass of active firms by η.

  Projects are rank-ordered, then $\frac{\partial q_\eta}{\partial \eta} < 0$ and $\frac{\partial \widehat{q}(\eta)}{\partial \eta} < 0$.

  Assume $q_1 A > 1$, then optimal that all firms operate at $K^* = L^*$.

- Agents are risk-neutral and consume at the end of the period.

Model

- Single Period (for now).
- Households (mass 1): $\overline{K} > K^*$.
- Firms (mass 1): L^* (no disutility) **and a unit of land.**

$$\texttt{Land Value} = \begin{cases} C > K^* & \texttt{with prob. } p_i \\ 0 & \texttt{otherwise} \end{cases}$$

- Agents can privately learn the type of land at cost
  - γ_l (in terms of K) for households.
  - γ_b (in terms of L) for firms.

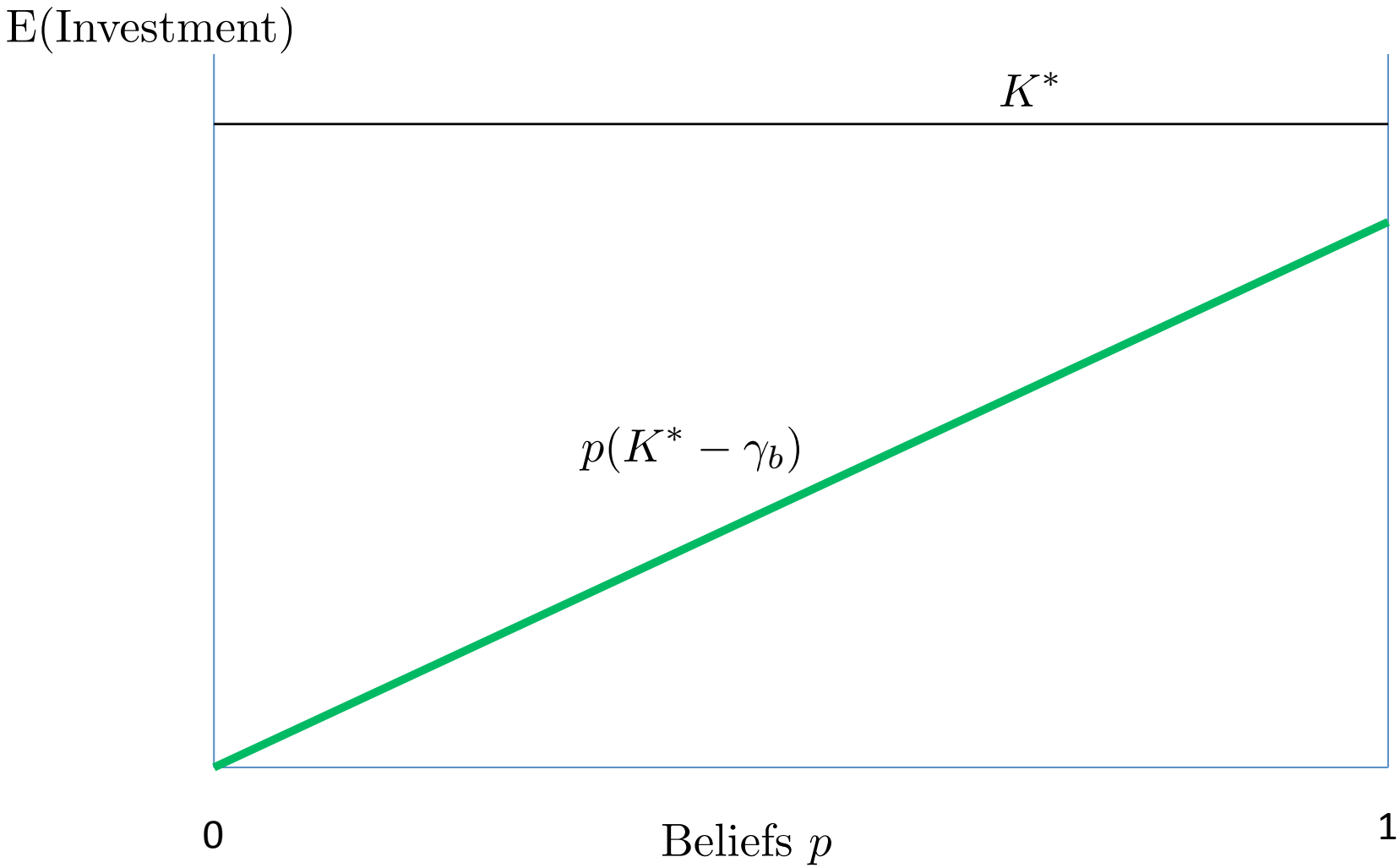
Symmetric Information

- Lenders break even and debt is risk free

$$p[\widehat{q}(\eta)R_{IS} + (1 - \widehat{q}(\eta))x_{IS}C] = pK + \underbrace{\gamma}_{\min\{\gamma_l, p\gamma_b(qA-1)\}}$$

$$R_{IS} = x_{IS}C$$

Symmetric Information



In this picture $\gamma = p\gamma_b(qA - 1)$

Symmetric Ignorance

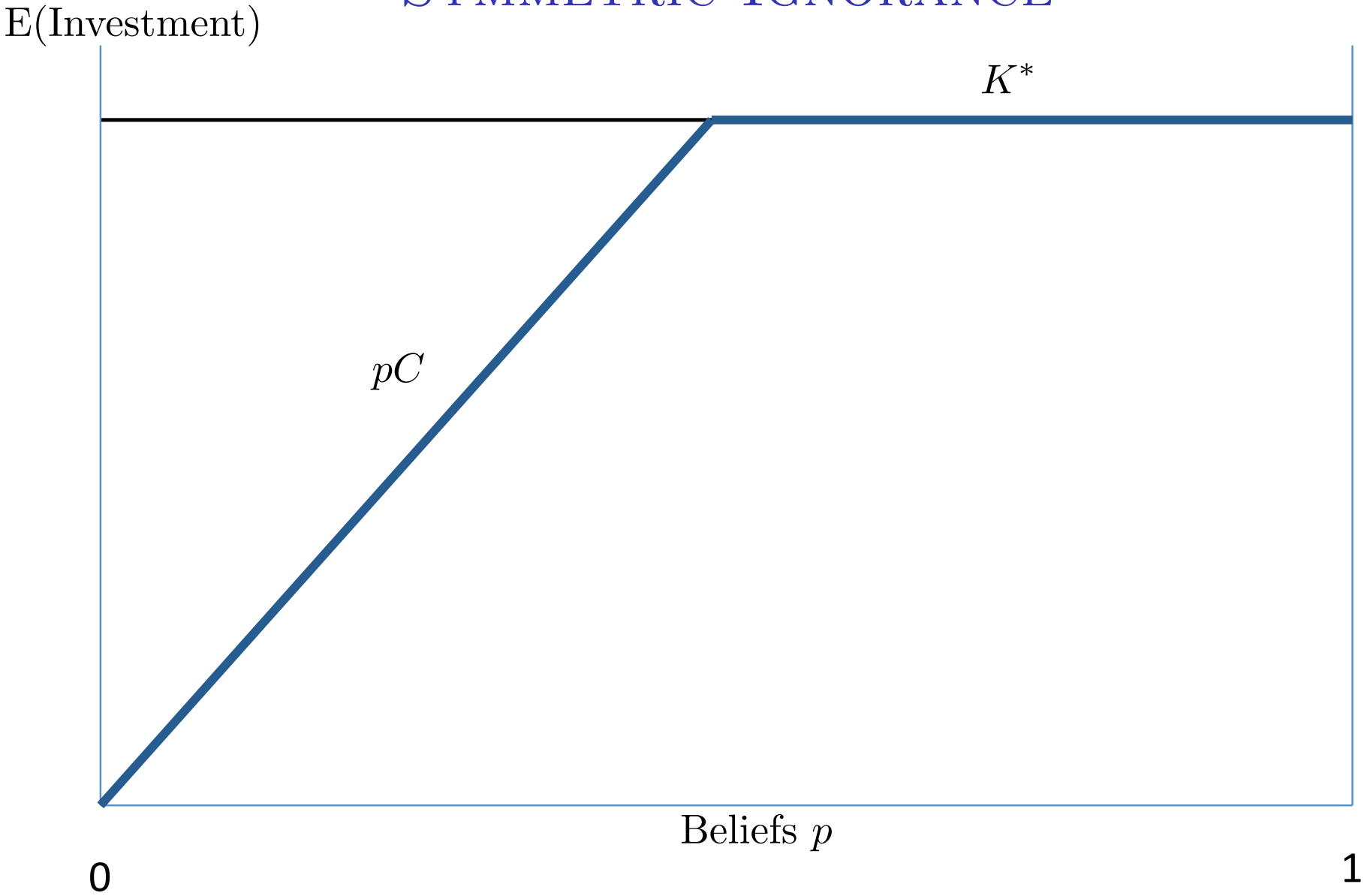
- Lenders break even and debt is risk free

$$\widehat{q}(\eta)R_{II} + (1 - \widehat{q}(\eta))x_{II}pC = K$$

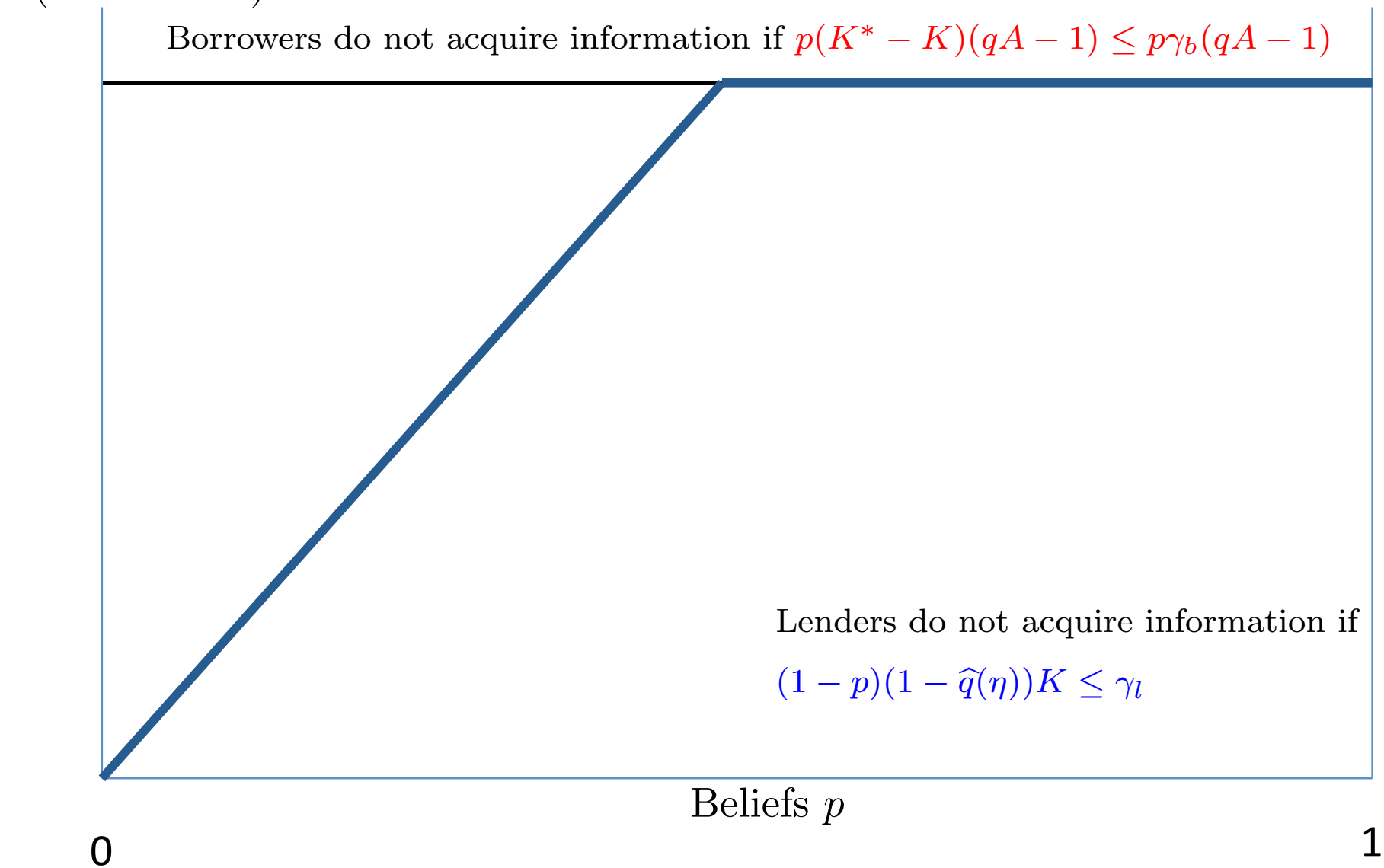
$$R_{II} = x_{II}pC$$

- Subject to loans not triggering private information acquisition.

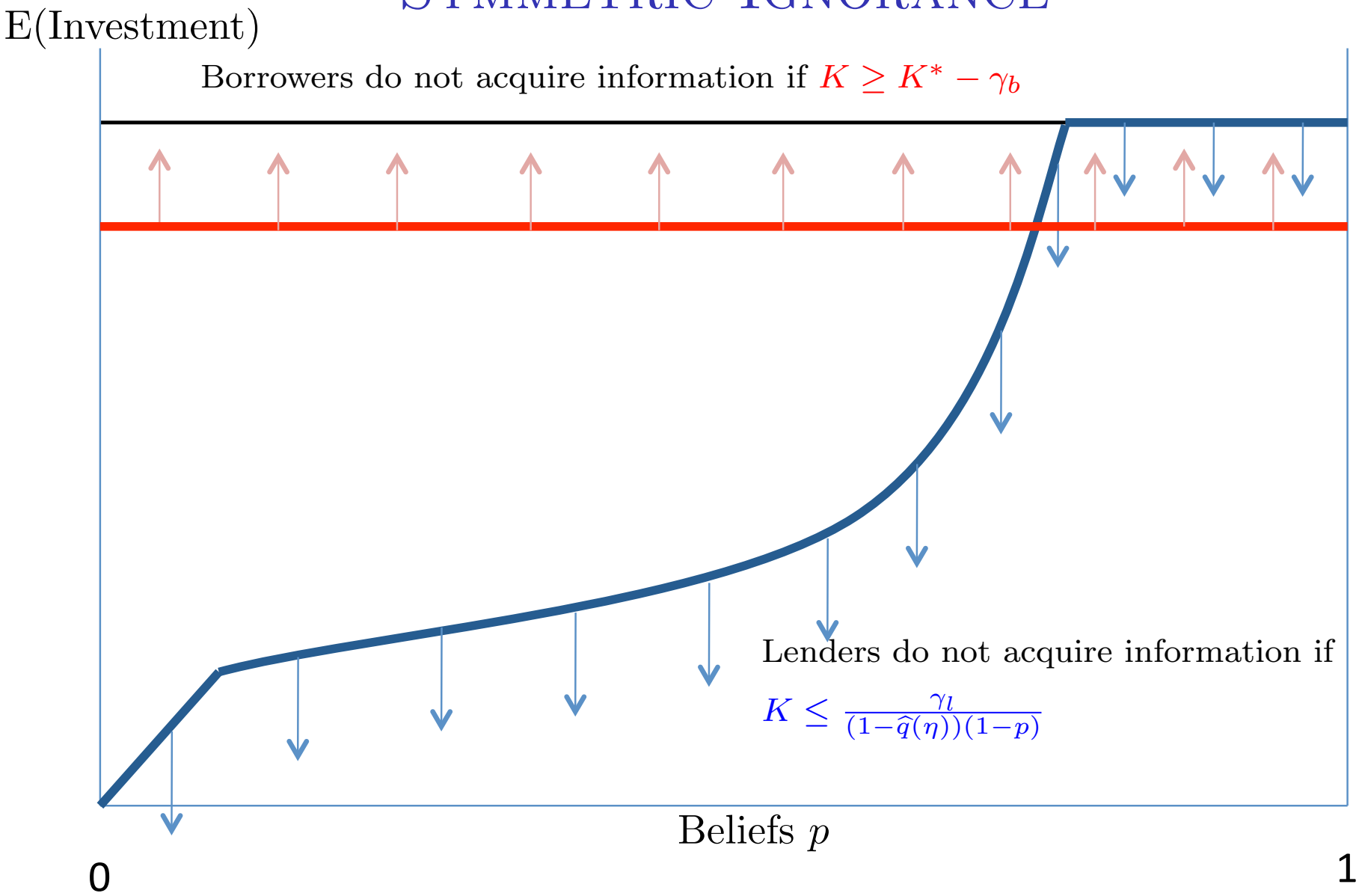
Symmetric Ignorance



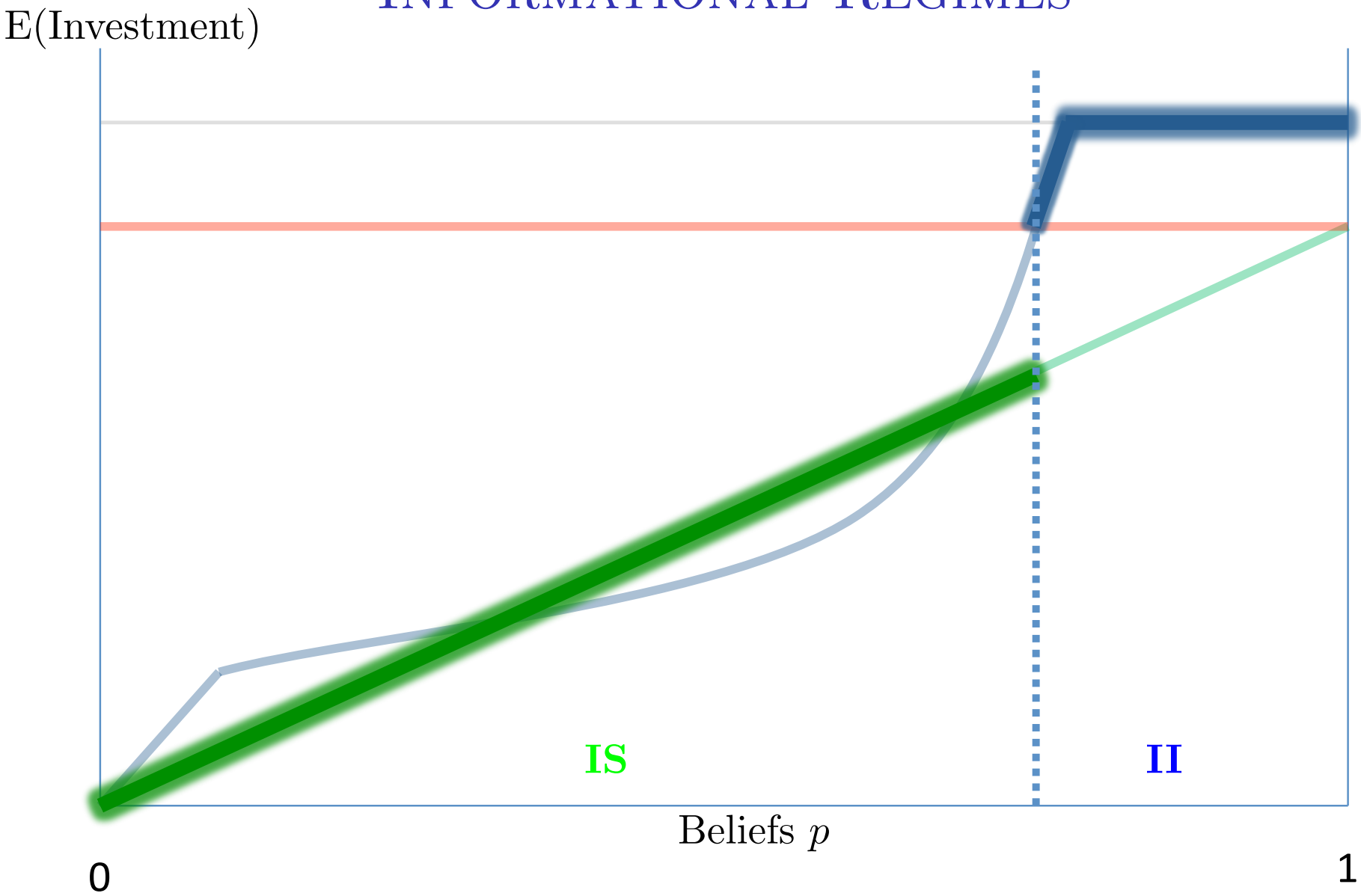
Symmetric Ignorance



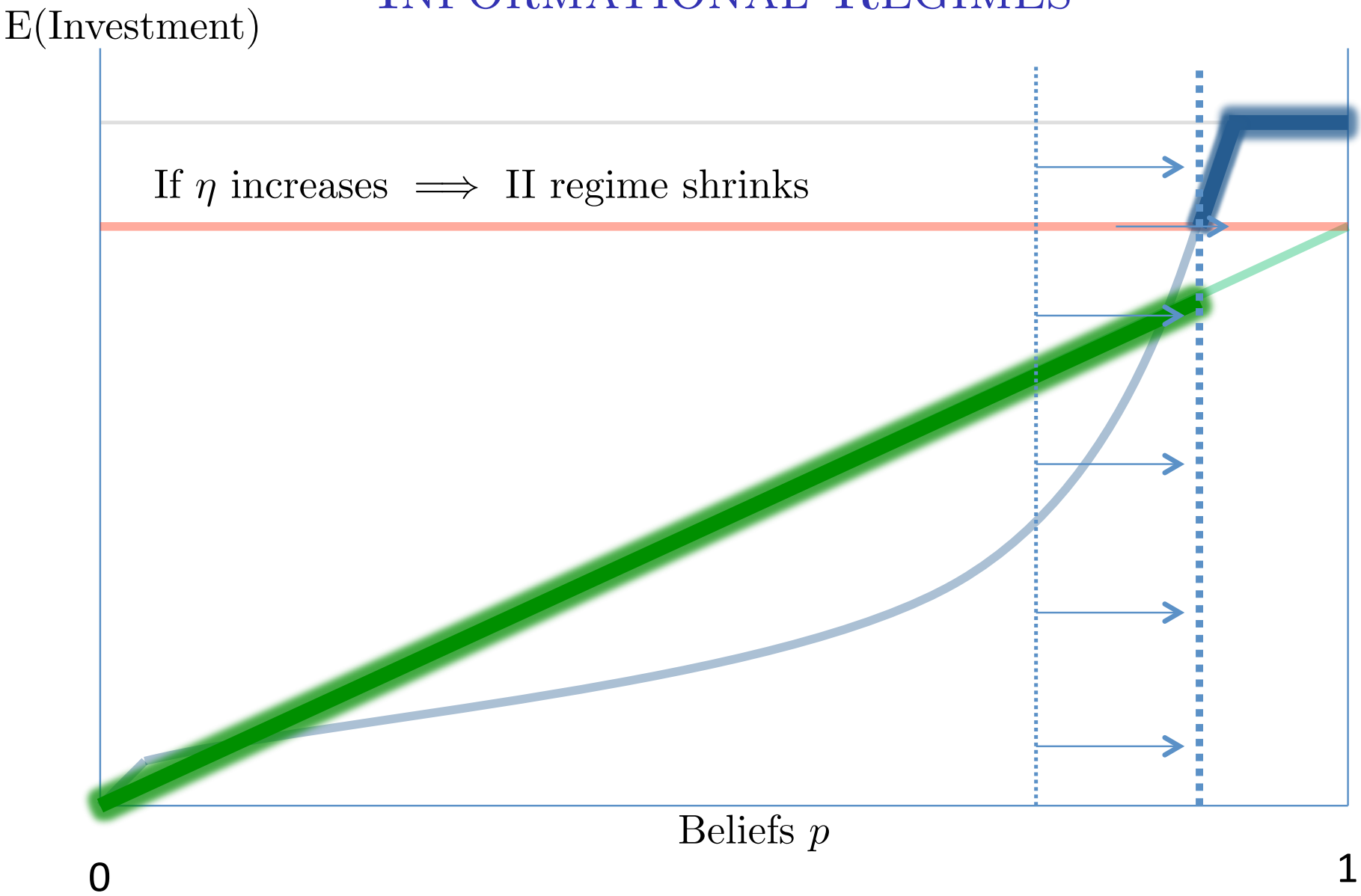
Symmetric Ignorance



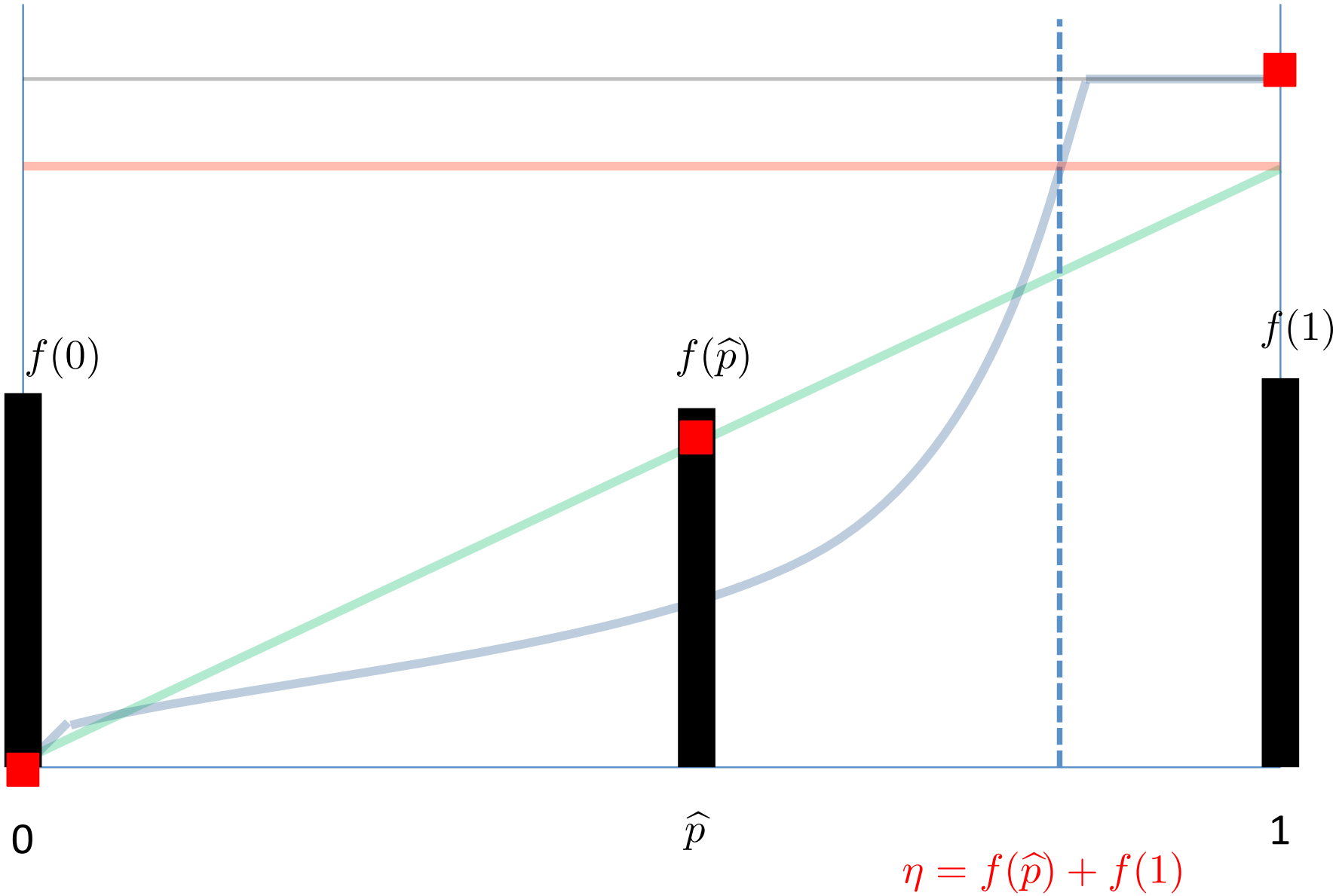
Informational Regimes



Informational Regimes



Simple Aggregation

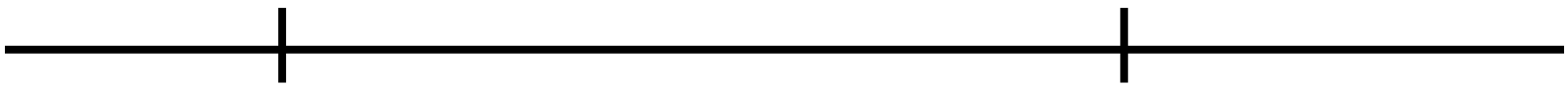


Dynamics

How does the distribution of beliefs (and the number of active firms) evolve over time?

- Dynamic extension.
  - OG: "young" households, "old" firms.
  - Land is storable, K is not.
  - Land is transferable across generations.
  - We assume away bubbles and multiplicity.
  - Price is pC (i.e., single match and buyers' negotiation power).

Timing



- A fraction η of firms w/ collateral p>0 and project q

- Each borrows K w/ II or IS debt (conditions R and x)

- Lenders or borrowers can privately observe the type of collateral.

Market for loans

- Project realization

- Debts are paid off and any info is revealed (p')

- Firms sell land at p'C to households.

Market for land

Timing

- A fraction η of firms w/ collateral p>0 and project q

- Each borrows K w/ II or IS debt (conditions R and x)

- Lenders or borrowers can privately observe the type of collateral.

Market for loans

- Project realization

- Debts are paid off and any info is revealed (p')

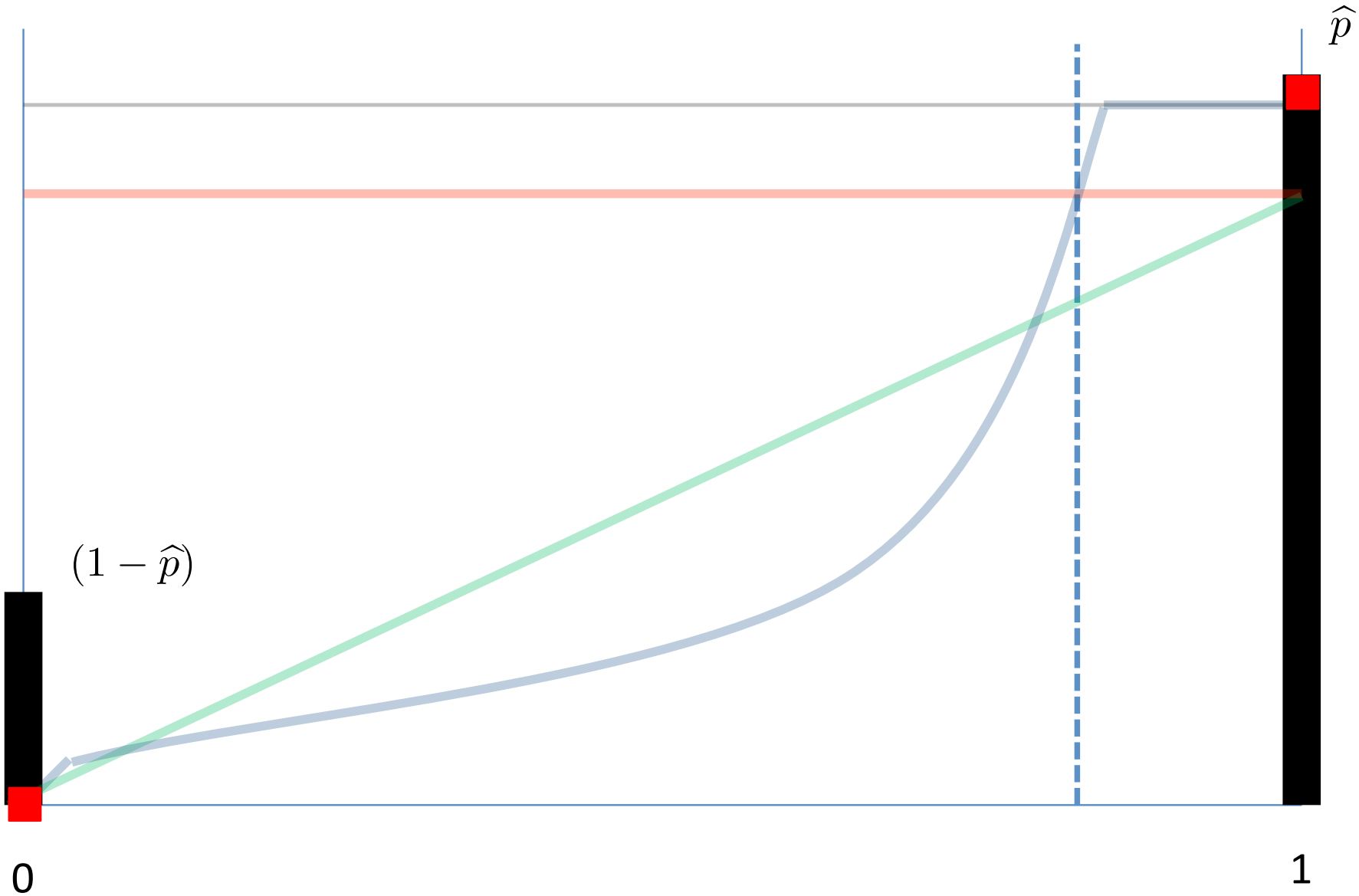
- Firms sell land at p'C to households.

Market for land

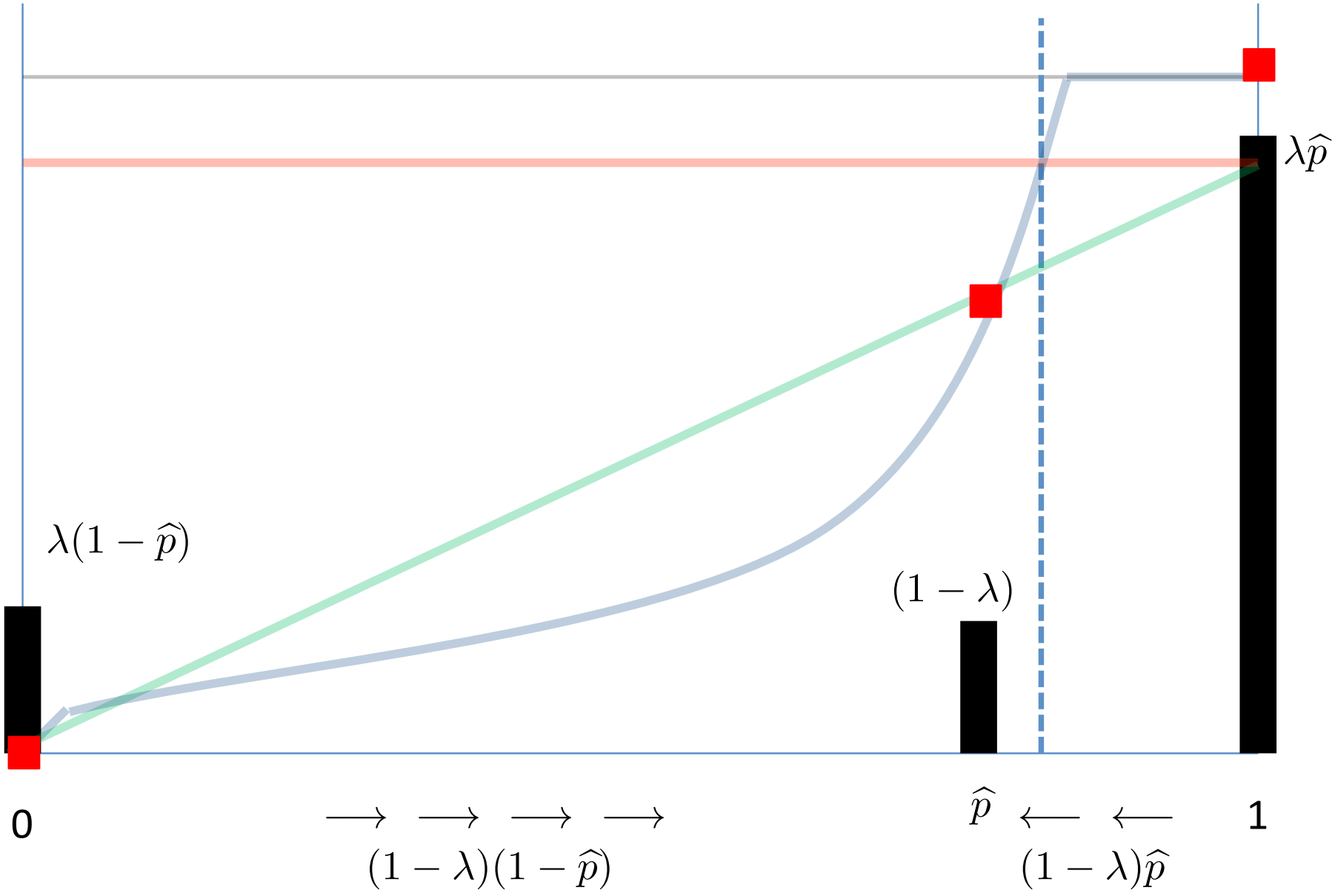
Shocks on Collateral

- Important assumption: Mean reversion of collateral.
- Simplifying assumptions
  - No aggregate shocks: Fraction of good land is always $\widehat{p}$.
  - Idiosyncratic shocks
    - Occur with probability $(1 - \lambda)$
    - Land becomes good with probability $\widehat{p}$.
    - The shock is observable, the realization is not.

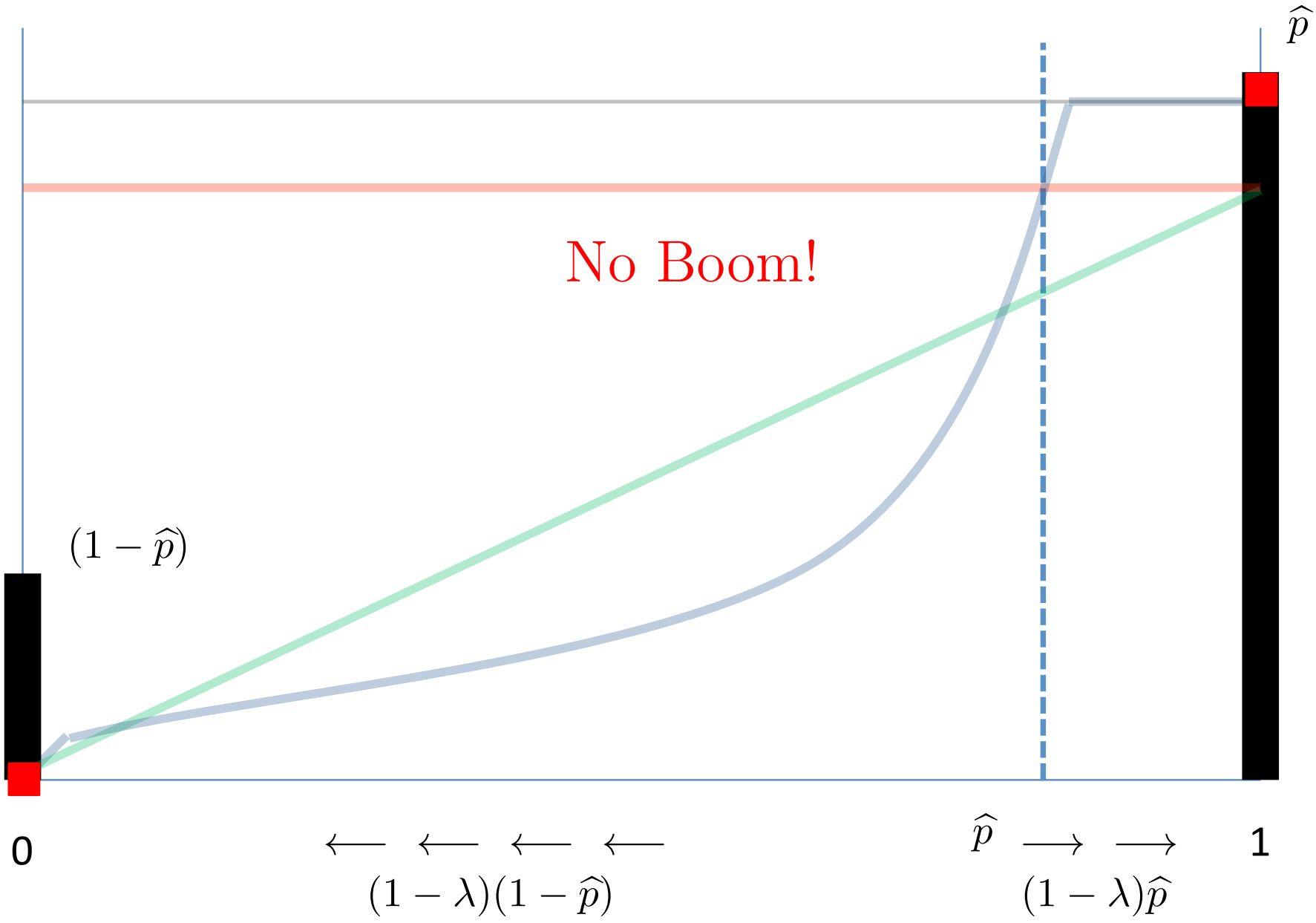
No Boom



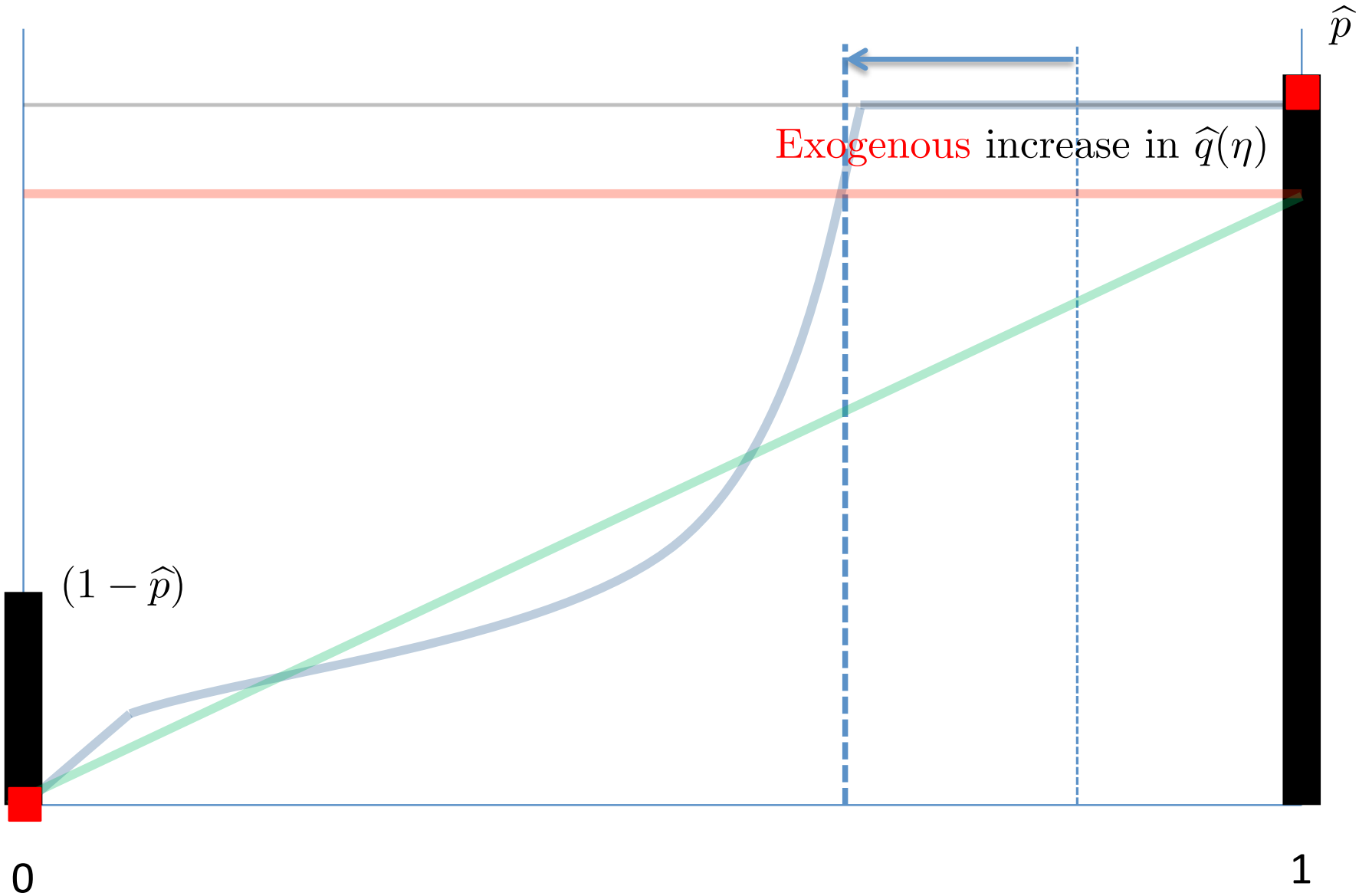
No Boom


$\lambda\widehat{p}$
$\lambda(1-\widehat{p})$
$(1-\lambda)$
0
$\longrightarrow \longrightarrow \longrightarrow \longrightarrow$
$(1-\lambda)(1-\widehat{p})$
$\widehat{p}$
$\longleftarrow \longleftarrow$
$(1-\lambda)\widehat{p}$
1

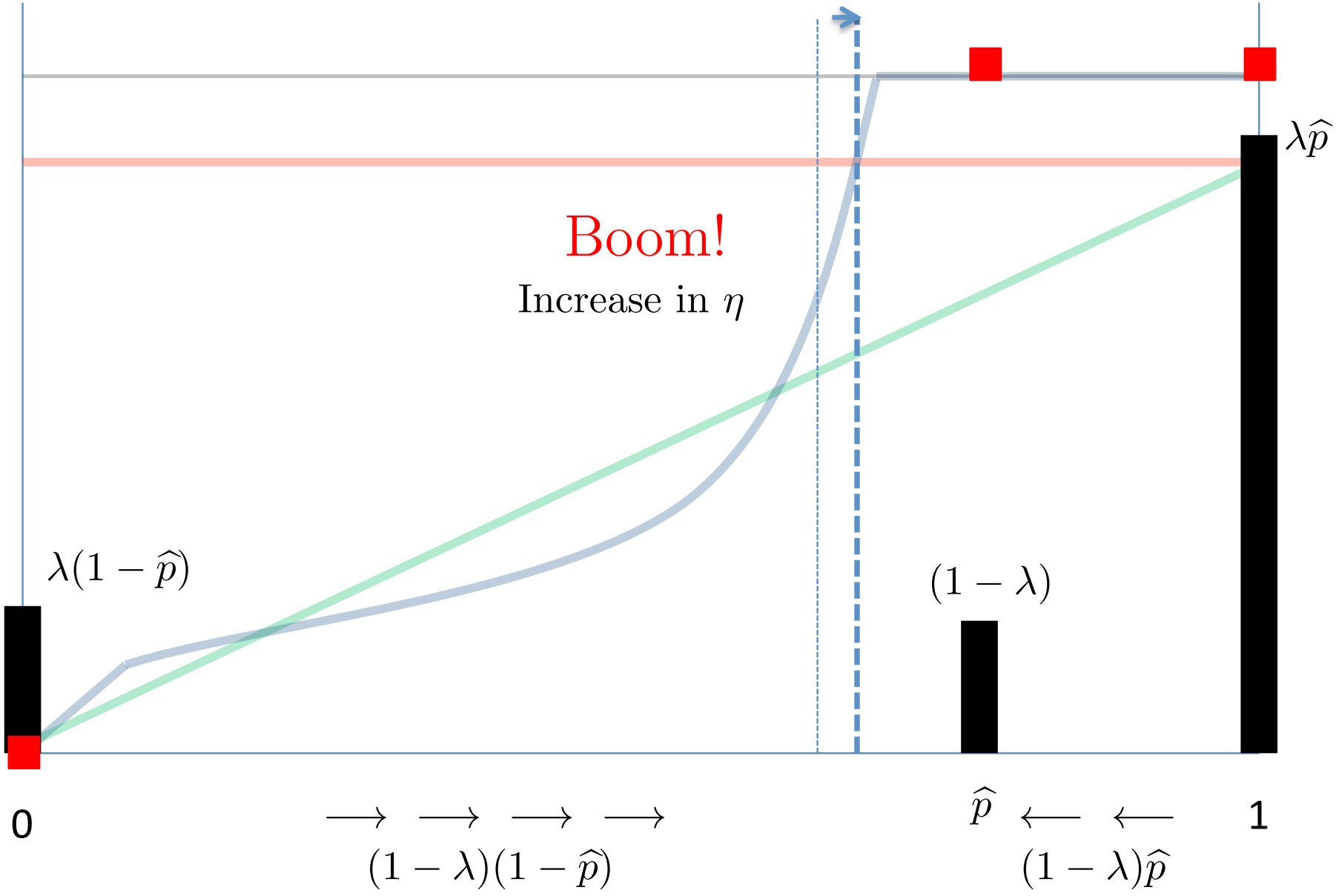
No Boom


$\widehat{p}$
No Boom!
$(1-\widehat{p})$
0
$\leftarrow \leftarrow \leftarrow \leftarrow$
$(1-\lambda)(1-\widehat{p})$
$\widehat{p}$
$\rightarrow \rightarrow$
$(1-\lambda)\widehat{p}$
1

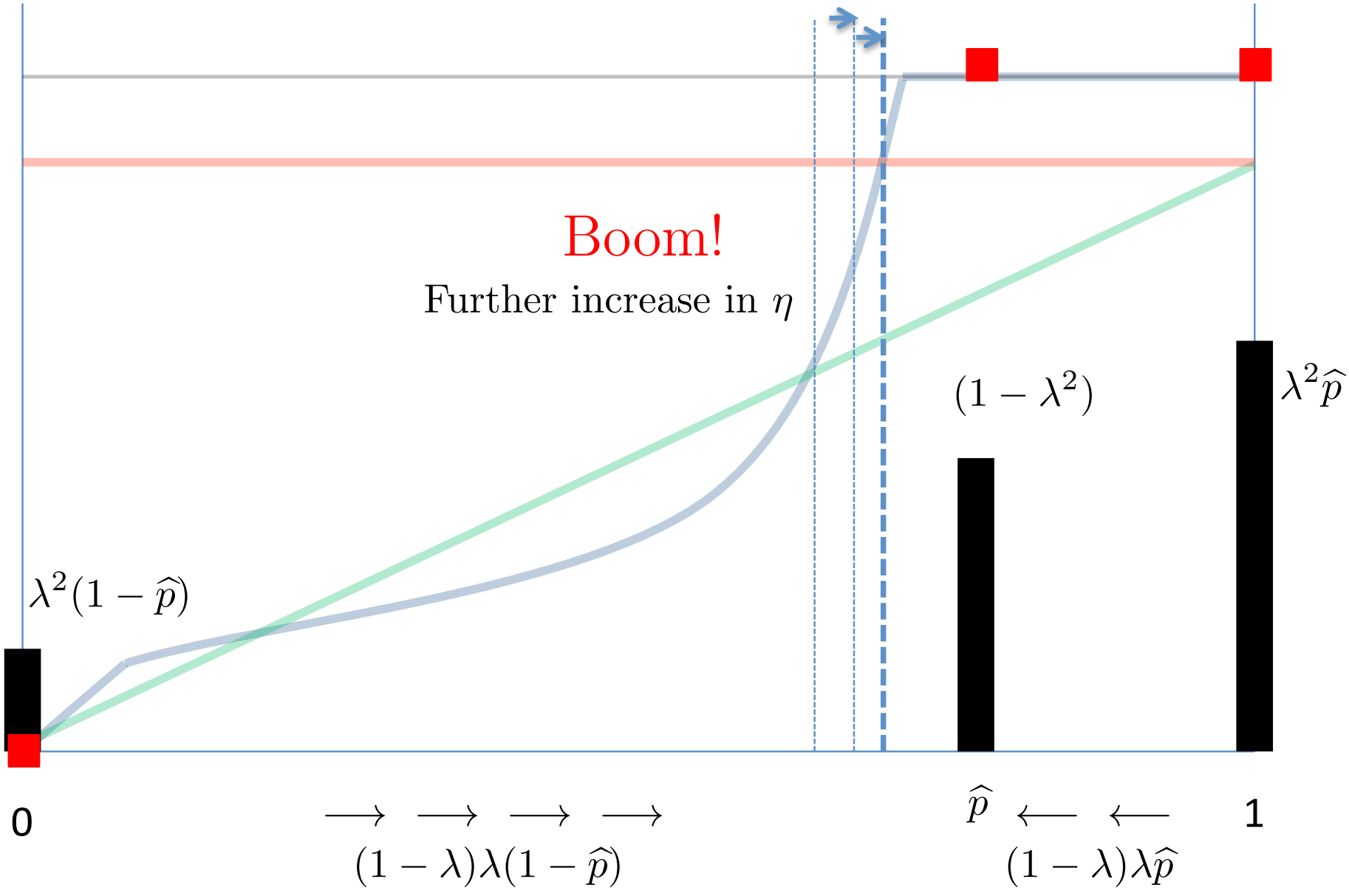
Good Booms



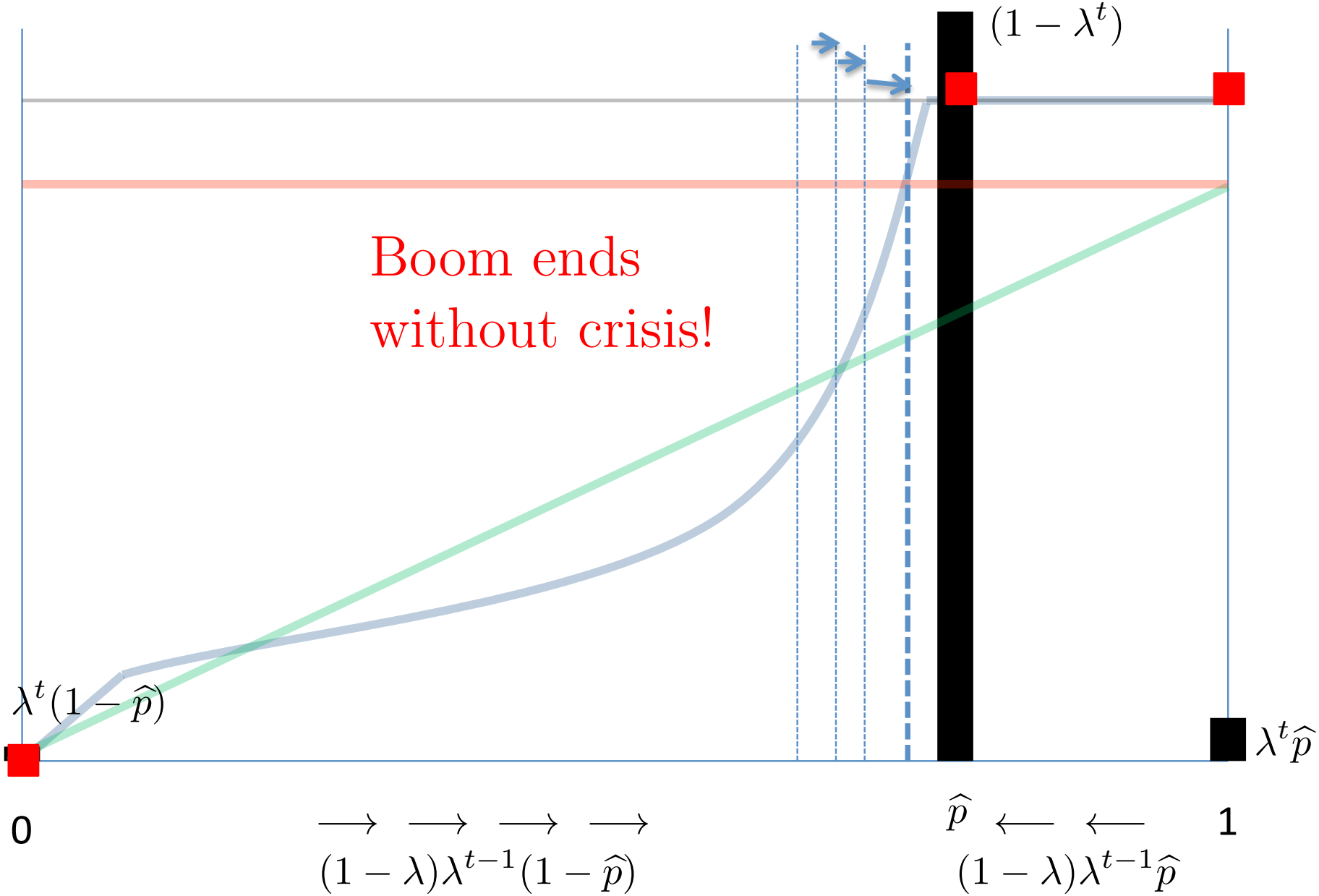
Good Booms


Boom!
Increase in η
$\lambda\widehat{p}$
$\lambda(1-\widehat{p})$
$(1-\lambda)$
0
$\widehat{p}$
1
$(1-\lambda)(1-\widehat{p})$
$(1-\lambda)\widehat{p}$

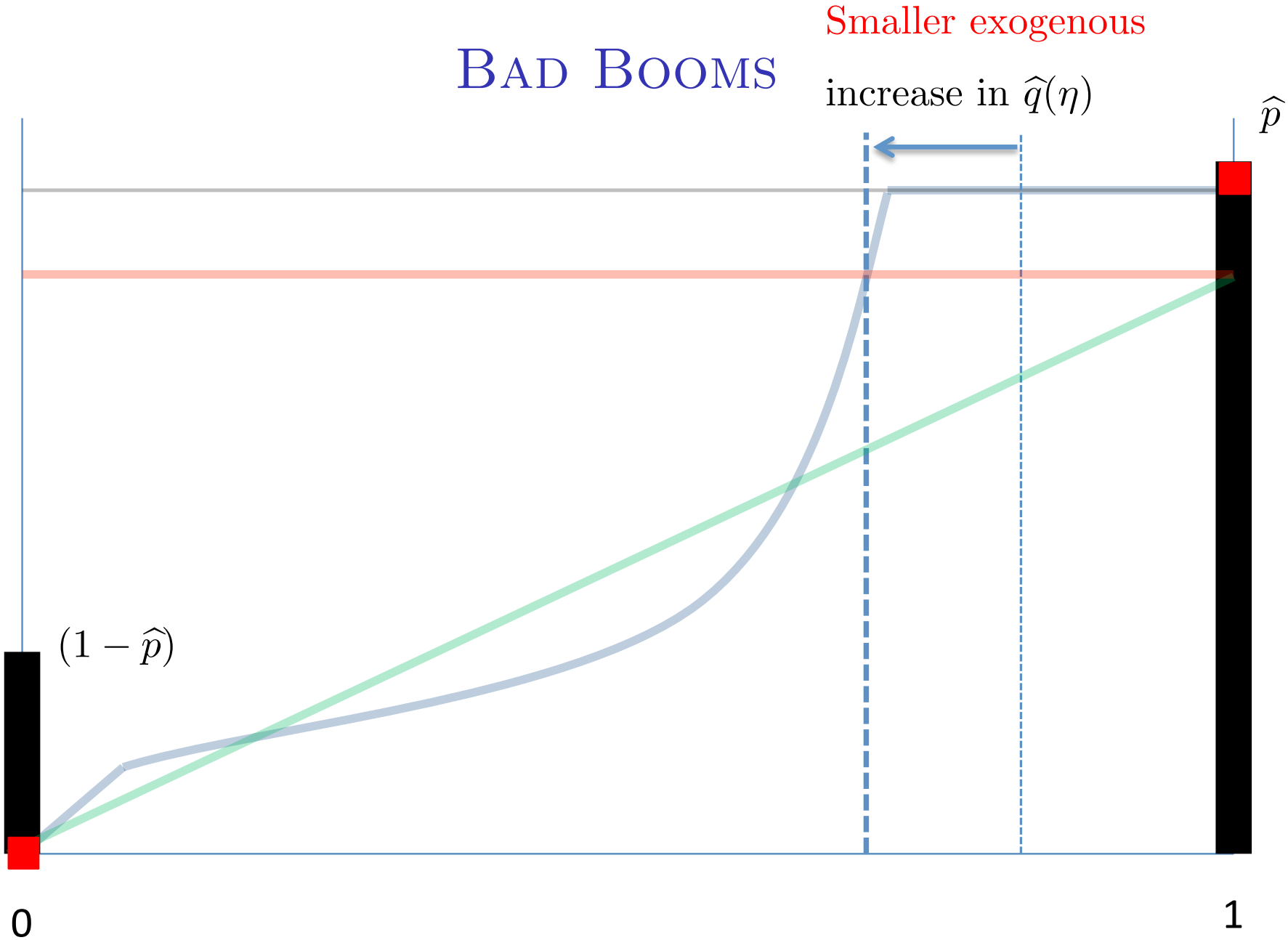
Good Booms


Boom!
Further increase in η
$\lambda^2(1-\widehat{p})$
$(1-\lambda^2)$
$\lambda^2\widehat{p}$
0
$\longrightarrow \longrightarrow \longrightarrow \longrightarrow$
$(1-\lambda)\lambda(1-\widehat{p})$
$\widehat{p}$
$\longleftarrow \longleftarrow$
1
$(1-\lambda)\lambda\widehat{p}$

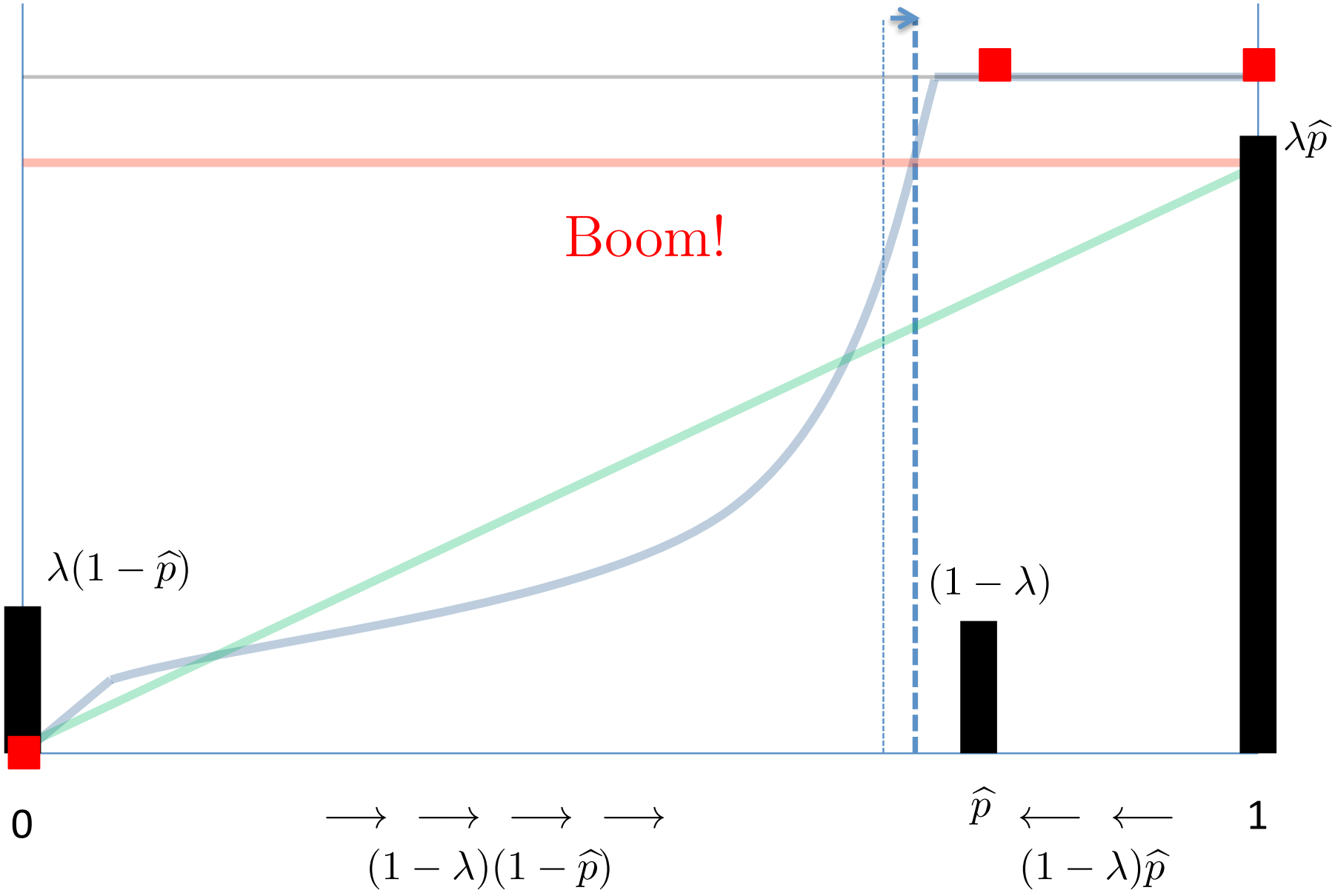
Good Booms


$(1-\lambda^t)$
Boom ends
without crisis!
$\lambda^t(1-\widehat{p})$
$\lambda^t\widehat{p}$
0
$\longrightarrow \longrightarrow \longrightarrow \longrightarrow$
$(1-\lambda)\lambda^{t-1}(1-\widehat{p})$
$\widehat{p}$ $\longleftarrow \longleftarrow$ 1
$(1-\lambda)\lambda^{t-1}\widehat{p}$

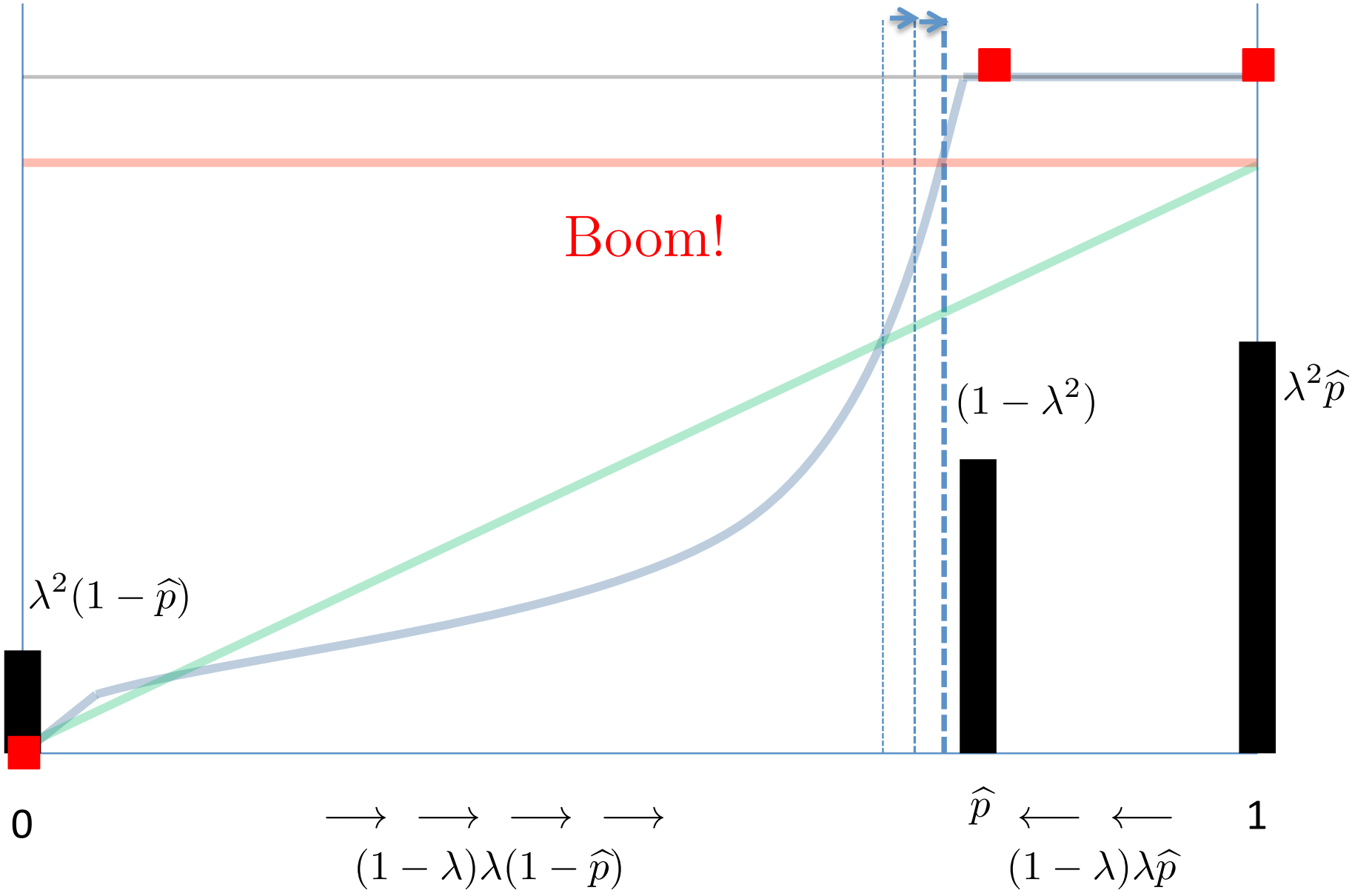
Bad Booms


Smaller exogenous
increase in $\widehat{q}(\eta)$
$\widehat{p}$
$(1-\widehat{p})$
0
1

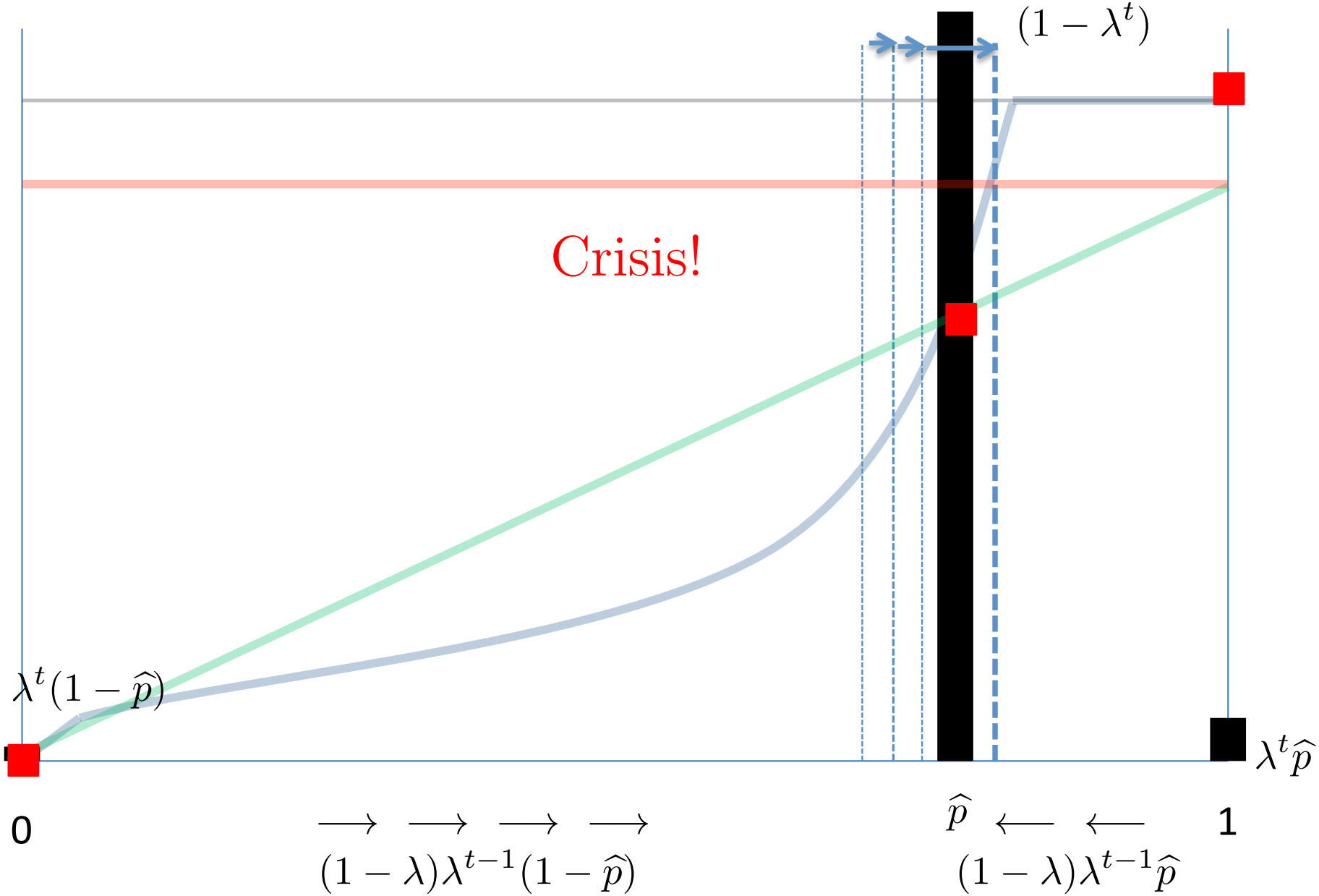
Bad Booms


Boom!
$\lambda\widehat{p}$
$\lambda(1-\widehat{p})$
$(1-\lambda)$
0
$\longrightarrow \longrightarrow \longrightarrow \longrightarrow$
$(1-\lambda)(1-\widehat{p})$
$\widehat{p}$
$\longleftarrow \longleftarrow$
$(1-\lambda)\widehat{p}$
1

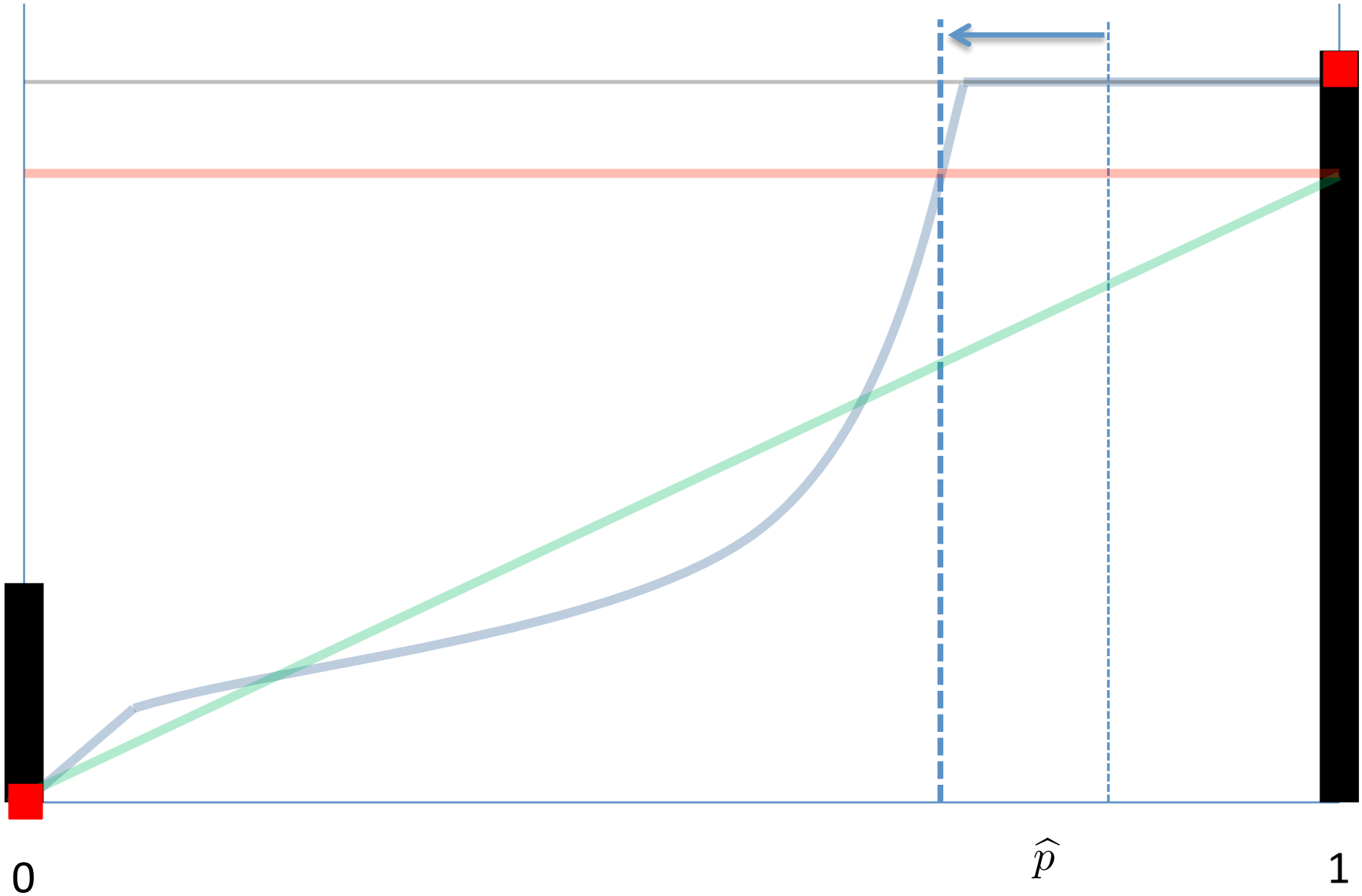
Bad Booms


Boom!
$\lambda^2(1-\widehat{p})$
$(1-\lambda^2)$
$\lambda^2\widehat{p}$
0
$\longrightarrow \longrightarrow \longrightarrow \longrightarrow$
$(1-\lambda)\lambda(1-\widehat{p})$
$\widehat{p}$
$\longleftarrow \longleftarrow$
1
$(1-\lambda)\lambda\widehat{p}$

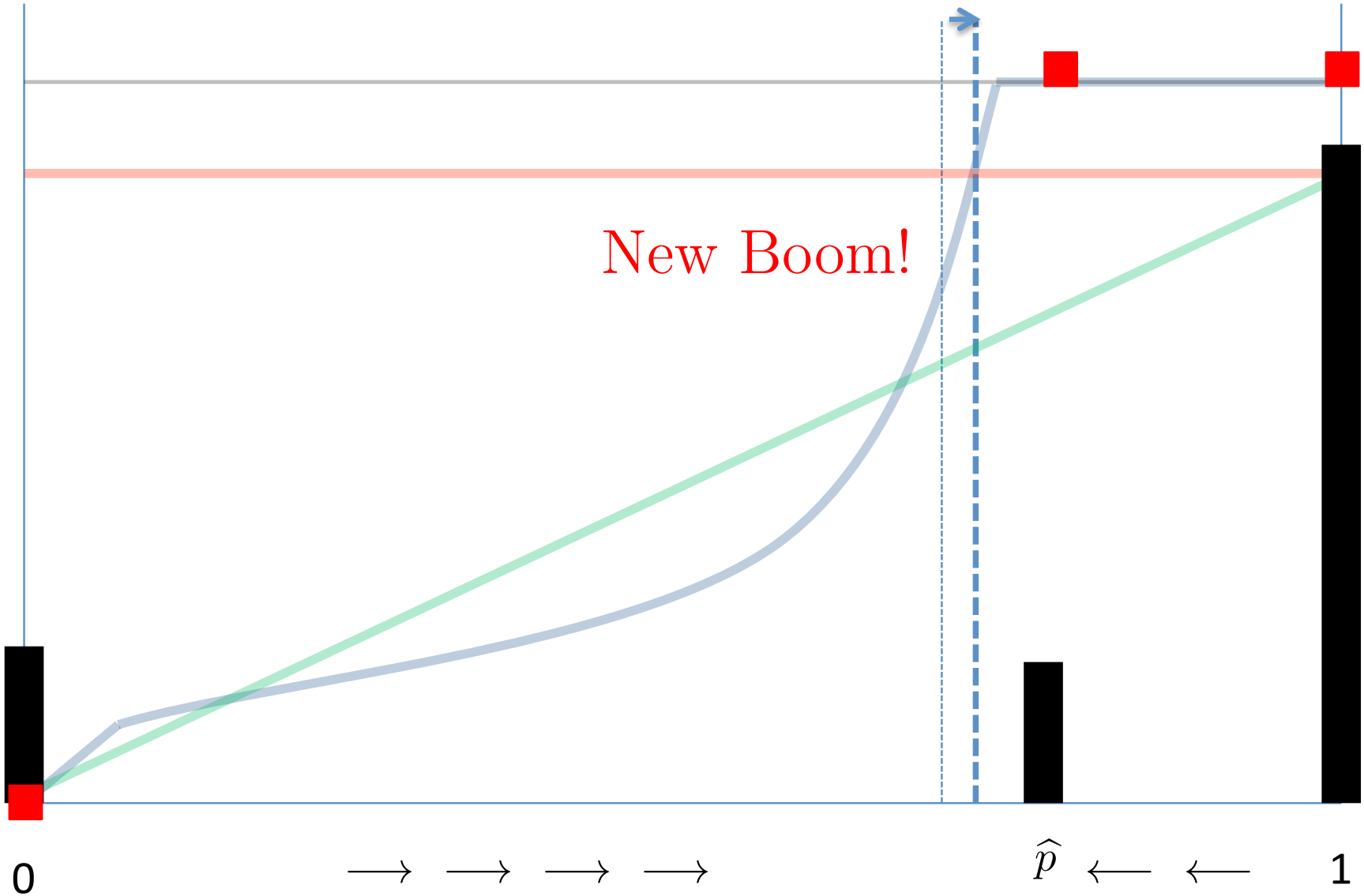
Bad Booms


$(1-\lambda^t)$
Crisis!
$\lambda^t(1-\widehat{p})$
$\lambda^t\widehat{p}$
0
$\longrightarrow \longrightarrow \longrightarrow \longrightarrow$
$(1-\lambda)\lambda^{t-1}(1-\widehat{p})$
$\widehat{p}$ $\longleftarrow \longleftarrow$ 1
$(1-\lambda)\lambda^{t-1}\widehat{p}$

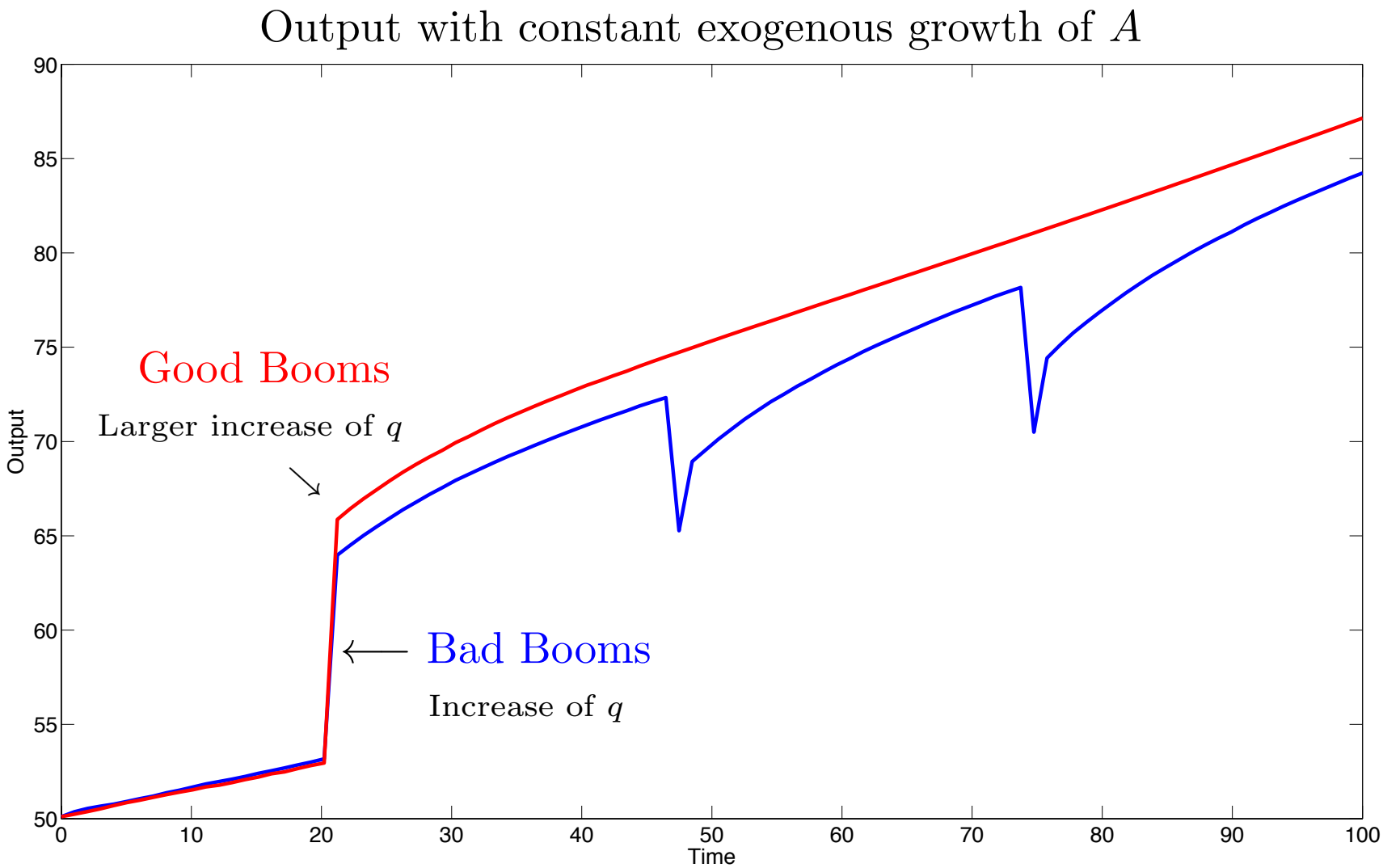
Bad Booms



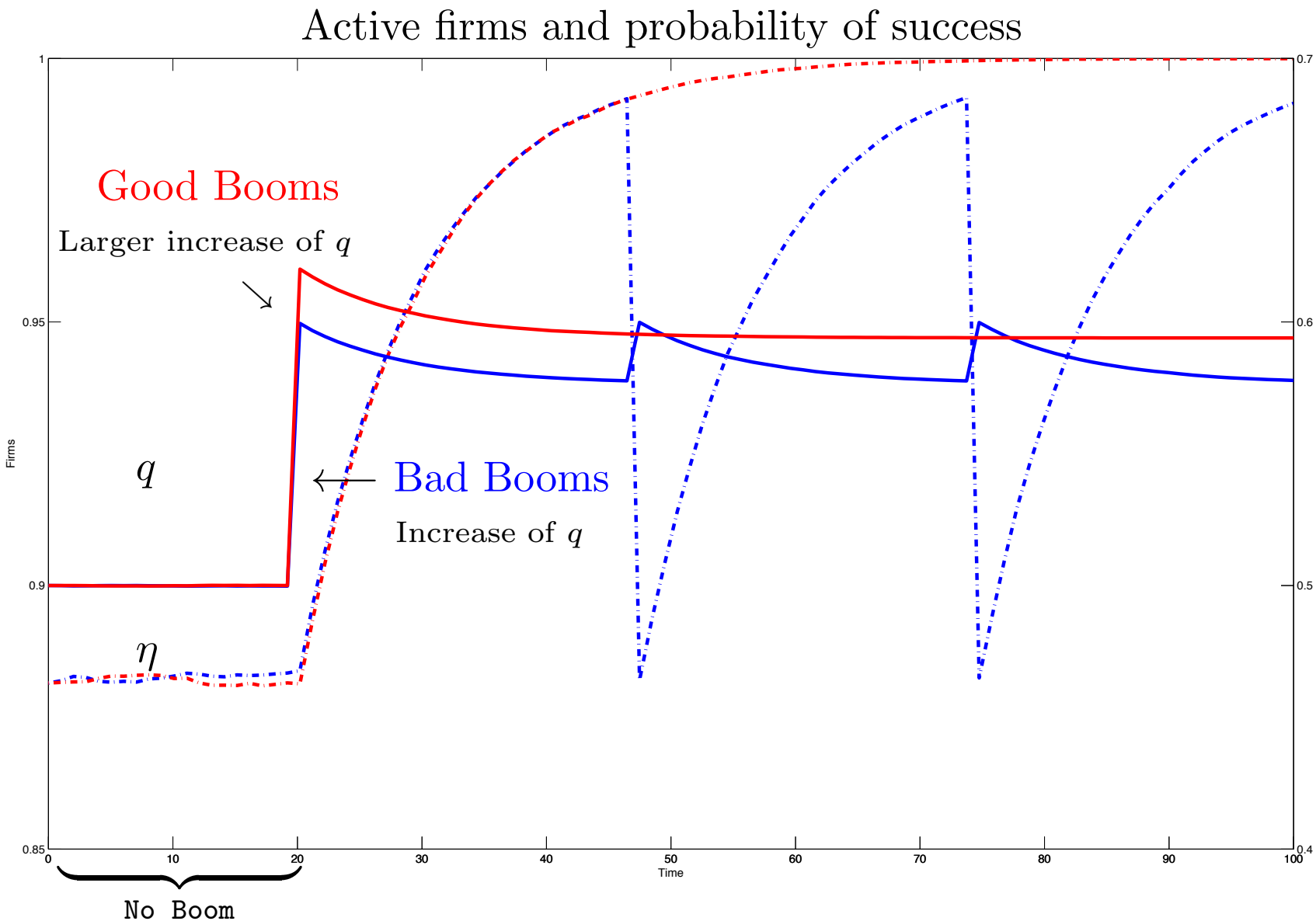
Bad Booms



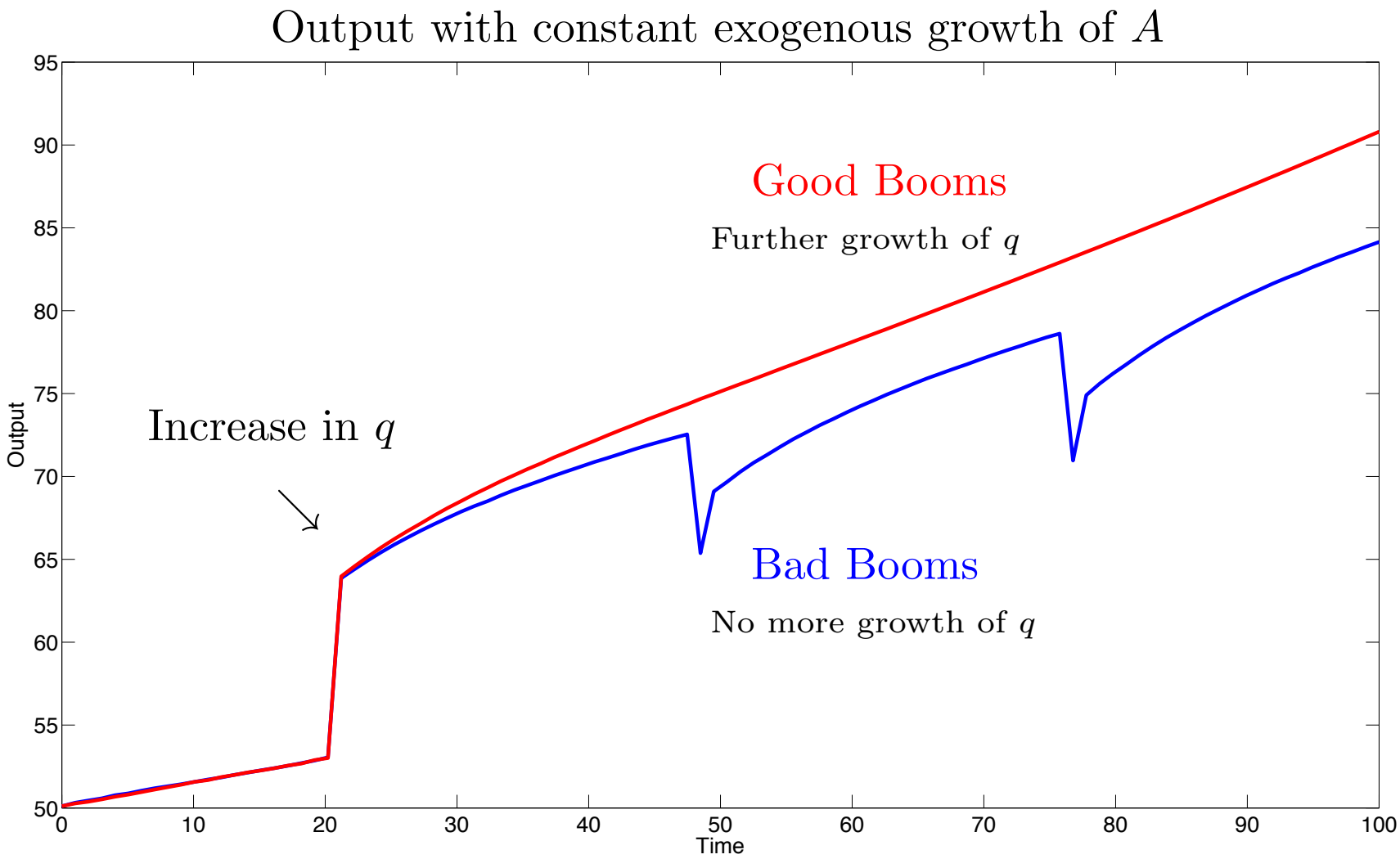
An Illustration - Different Jumps of q



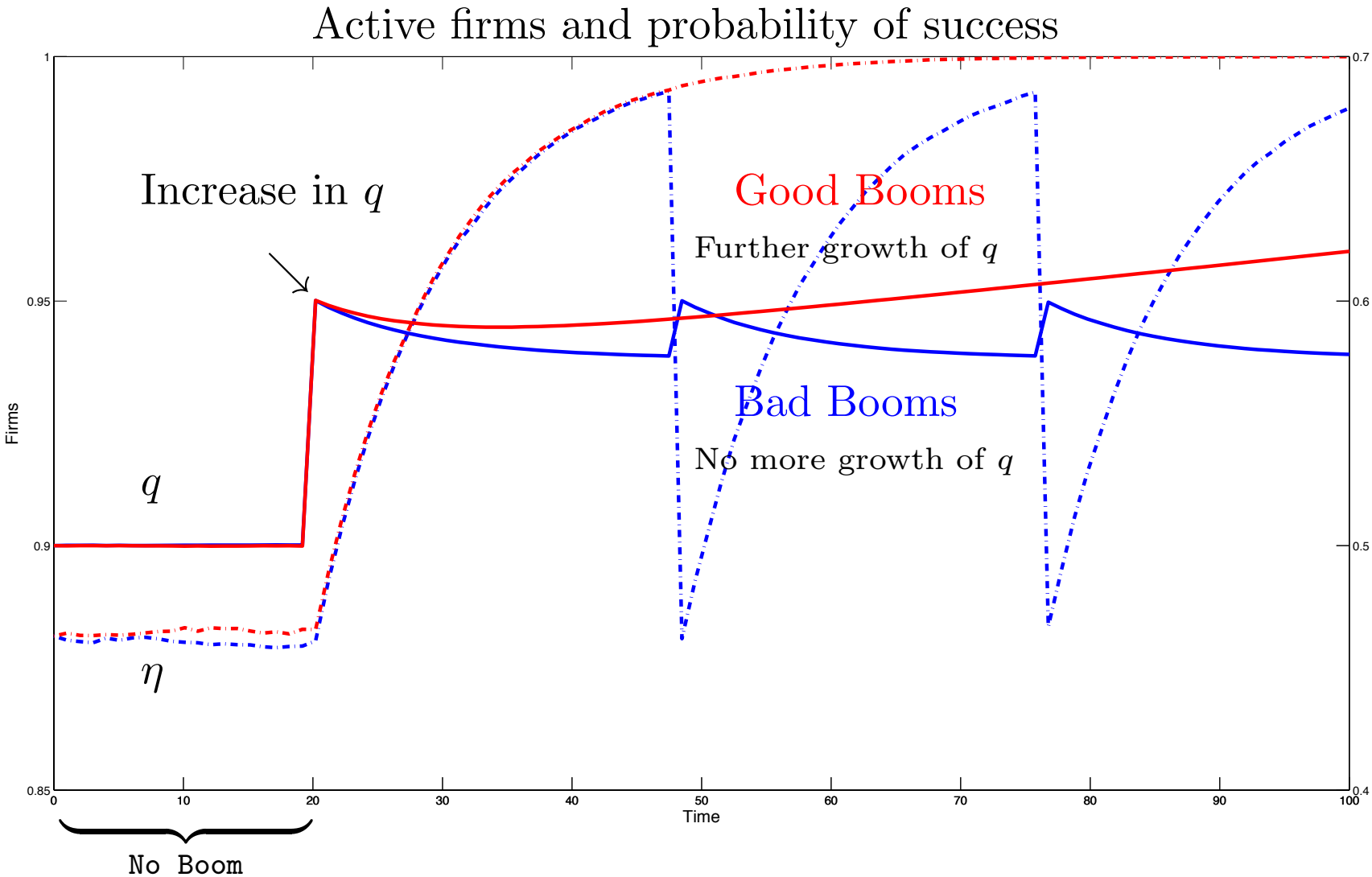
An Illustration - Different Jumps of q



An Illustration - Different Growth of q



An Illustration - Different Growth of q



Decomposing TFP

- In the model, $TFP = qA$.
  - The literature assumes $q = 1$, but this is the component that affects the likelihood of crises, not A!

- Problem: Not comprehensive data on q.
  - We proxy q by the distance to solvency, $\frac{1}{vol}$, where vol is the volatility of firms' equity returns (as in Atkeson et al. (2013)).

Testing Assumptions and Predictions

- Distance to solvency is a significant component of TFP.

$$\Delta(TFP)_{j,t} = \alpha + \beta \Delta \frac{1}{vol_{j,t}} + \epsilon_{j,t}$$

$$0.02^{***}$$

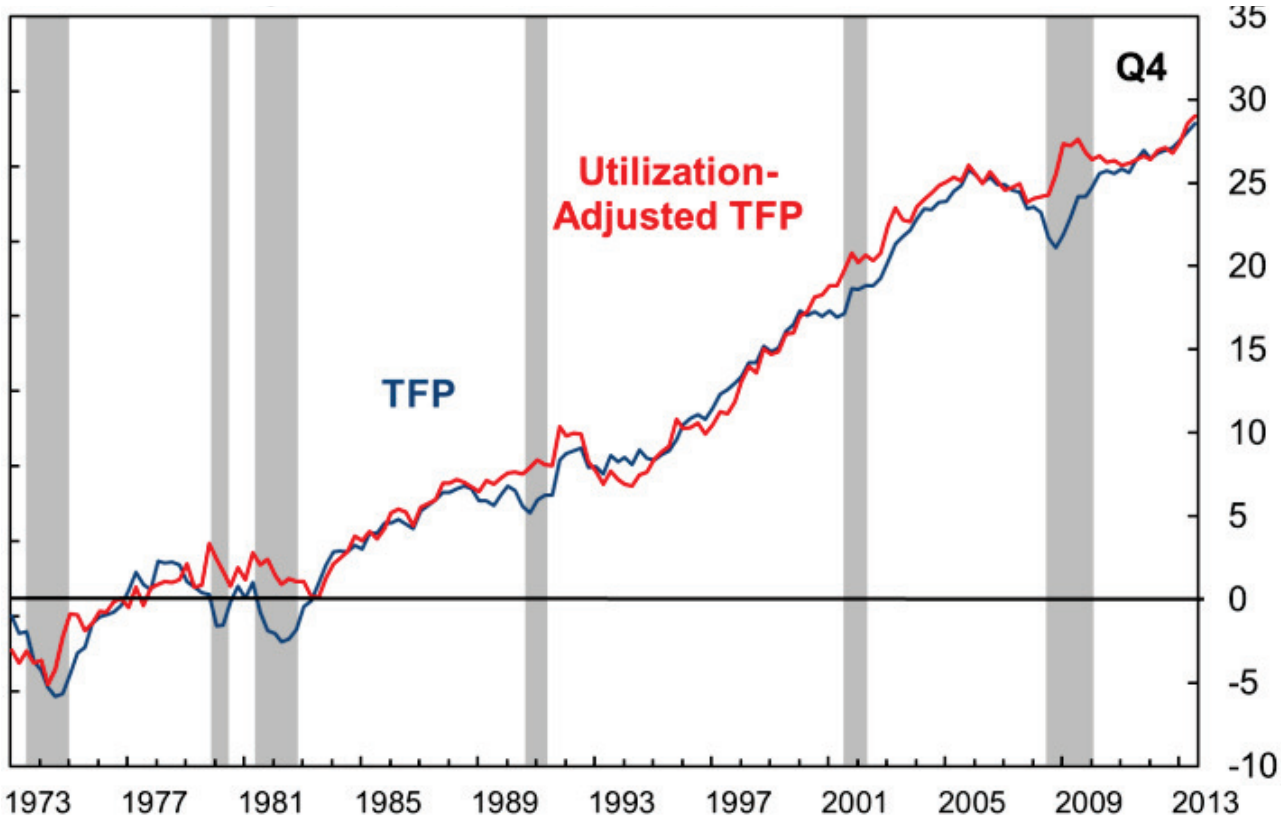
- Distance to solvency predicts bad booms.

$$Pr\left(BadBoom_{j,t} | Boom_{j,t}\right) = Logit\left(\alpha + \beta \frac{1}{vol_{j,t-1}}\right)$$

$$-0.10^{***}$$

Final Remarks

- Most macro models rely on exogenous contemporaneous "negative technology shocks". Not the case in the recent crisis!



Final Remarks

- We propose a unified model of booms and crises, where crises may be the result of a contemporaneous shock, but also the result of previous endogenous dynamics!

  The seeds of a crisis may be planted years beforehand!

- Aggregate fluctuations are related to low frequency phenomena.

  The trend affects the cycle!

- We have decomposed credit into household and corporate in the data and extended the model to capture mortgages.

  Same results and same forces!

Summary Statistics

	Whole Sample	Non Booms	Booms	t-Statistic for Means	Booms with a Crisis	Booms without a Crisis	t-Statistic for Means
Avg. Credit growth (%)	3.83	-2.41	8.96	15.02	9.84	8.30	1.27
Avg. H'd Cr'd growth (%)	6.07	3.93	7.55	1.07	6.71	8.47	-1.64
Avg. C't Cr'd growth (%)	1.76	-0.83	3.58	6.39	3.57	3.59	-0.04
Avg. TFP growth (%)	0.83	0.78	0.87	0.62	0.47	1.17	-3.57
Avg. Pt Gnt'd growth (%)	0.17	0.17	0.18	0.00	-0.68	0.93	-0.50
Avg. rGDP growth (%)	2.56	2.29	2.78	3.08	2.40	3.07	-3.28
Avg. INV growth (%)	1.48	1.08	1.79	2.19	1.67	1.88	-0.49
Avg. LP growth (%)	2.52	2.45	2.57	0.72	2.06	2.96	-4.29
Avg. Duration (years)			10.68		11.76	9.98	0.93
Avg. Time spent in boom			27.32		11.76	15.56	
Number of Booms			87		34	53	
Sample Size (years)	1695	766	929		400	529	

Summary Statistics

Table 3: Descriptive Statistics - Advanced Economies

	Whole Sample	Non Booms	Booms	t-Statistic for Means	Booms with a Crisis	Booms without a Crisis	t-Statistic for Means
Avg. Credit growth (%)	4.26	-0.94	7.37	8.55	7.31	7.42	-0.06
Avg. H'd Cr'd growth (%)	3.87	1.10	5.46	6.60	5.78	5.03	1.16
Avg. C't Cr'd growth (%)	1.98	0.11	3.07	5.26	3.18	2.91	0.39
Avg. TFP growth (%)	0.74	0.77	0.73	-0.21	0.37	1.04	-2.91
Avg. Pt Gnt'd growth (%)	-2.24	-2.64	-2.00	0.23	-0.74	-3.11	0.72
Avg. rGDP growth (%)	2.49	2.33	2.59	1.34	2.21	2.92	-3.02
Avg. INV growth (%)	1.61	1.07	1.90	1.94	1.81	1.99	-0.35
Avg. LP growth (%)	2.77	2.90	2.69	-1.25	2.25	3.07	-3.73
Avg. Duration (years)			13.38		15.93	11.79	1.25
Avg. Time spent in boom			29.00		13.28	15.72	
Number of Booms			39		15	24	
Sample Size (years)	834	312	522		239	283	

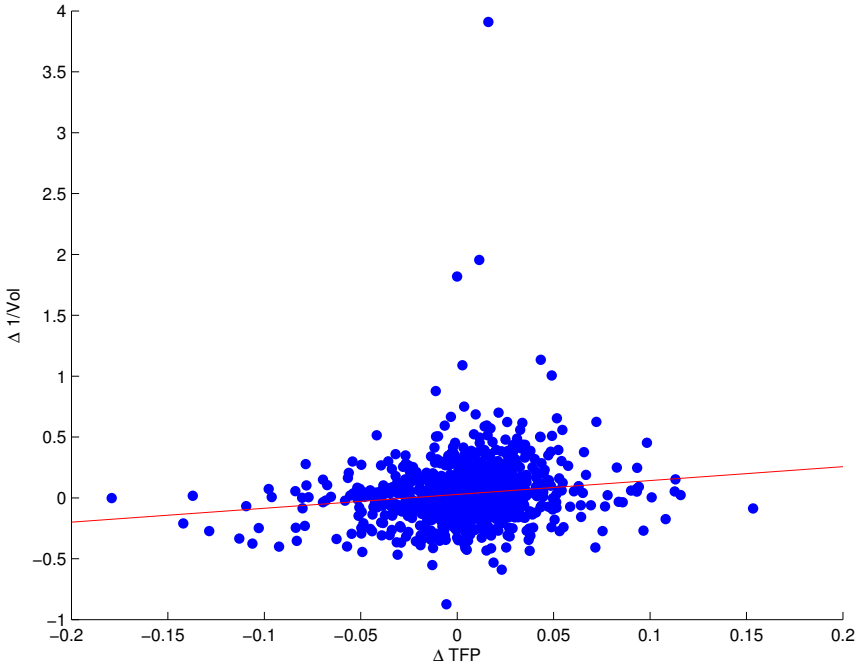
Table 4: Descriptive Statistics - Emerging Economies

	Whole Sample	Non Booms	Booms	t-Statistic for Means	Booms with a Crisis	Booms without a Crisis	t-Statistic for Means
Avg. Credit growth (%)	3.40	-3.41	11.00	14.30	13.60	9.31	2.95
Avg. H'd Cr'd growth (%)	14.80	11.03	19.96	0.75	19.31	20.18	-0.16
Avg. C't Cr'd growth (%)	0.92	-3.13	6.46	4.30	8.82	5.67	1.15
Avg. TFP growth (%)	0.91	0.78	1.06	1.15	0.63	1.33	-2.00
Avg. Pt Gnt'd growth (%)	3.40	2.75	4.17	0.29	-0.57	8.38	-1.28
Avg. rGDP growth (%)	2.63	2.26	3.04	3.09	2.72	3.24	-1.45
Avg. INV growth (%)	1.32	1.09	1.59	0.98	1.35	1.72	-0.46
Avg. LP growth (%)	2.13	1.98	2.32	1.07	1.54	2.76	-2.42
Avg. Duration (years)			8.48		8.47	8.48	-0.00
Avg. Time spent in boom			22.61		8.94	13.67	
Number of Booms			48		19	29	
Sample Size (years)	861	454	407		161	246	

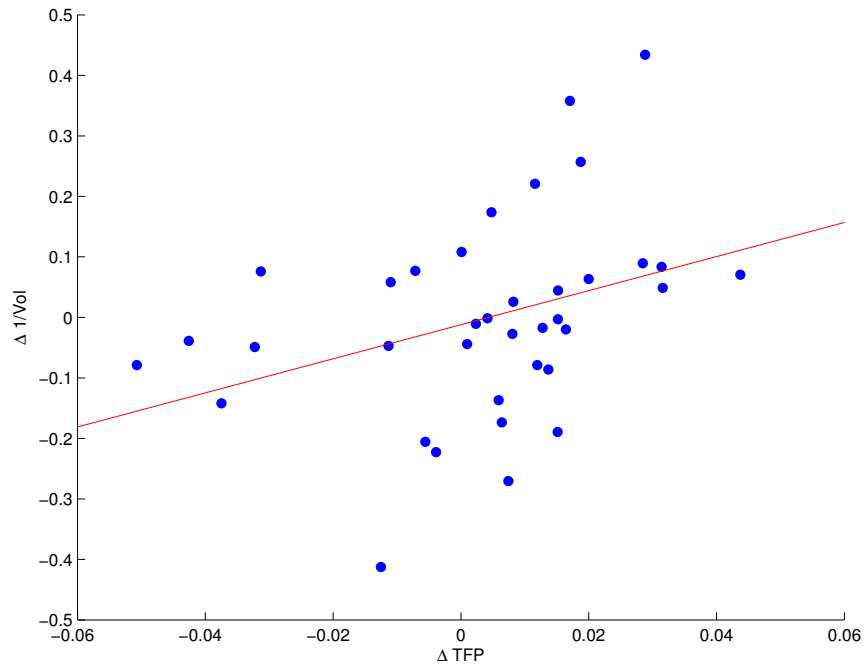
Household Credit

	Whole Sample	Non Booms	Booms	t-Statistic for Means	Booms with a Crisis	Booms without a Crisis	t-Statistic for Means
Avg. H'd Cr'd growth (%)	6.07	3.13	7.99	1.40	6.99	9.62	-2.30
Avg. TFP growth (%)	0.53	0.29	0.69	1.82	0.41	1.15	-2.65
Avg. Pt Gnt'd growth (%)	-0.81	-2.14	-0.00	0.72	2.76	-4.84	1.72
Avg. rGDP growth (%)	2.28	1.83	2.58	3.16	2.23	3.16	-2.91
Avg. INV growth (%)	1.87	1.60	2.04	0.89	1.92	2.24	-0.47
Avg. LP growth (%)	2.13	2.07	2.17	0.47	1.95	2.54	-2.09
Avg. Duration (years)			11.53		13.41	9.40	1.61
Avg. Time spent in boom			18.45		11.40	7.05	
Number of Booms			32		17	15	
Sample Size (years)	610	241	369		228	141	

Default as a Component of Productivity



(a) Whole Sample



(b) United States