Measuring competition

Jan Boone

Tilec

May 28, 2010

Outline

Introduction

What is wrong with standard competition measures?

New competition measure

Profit elasticity (PE) in Dutch data

Identifying the reallocation effect

Policy implications

References

- This presentation is based on papers with co-authors:
- Boone (2008)
- Boone, Van Ours and Van der Wiel (2010)
- Boone and Goeree (2010)

Motivation I

- For both policy and academic research it is important to measure competition
- Examples of policy applications:
  - a market is liberalized, policy makers want to monitor whether competition intensifies over time
  - have firms managed to form a cartel and reduce competition intensity?
  - allowing a merger in a sector that is becoming more competitive over time can be less problematic than in a sector where competition falls over time
- Examples of research questions:
  - does more intense competition lead to higher productivity
  - what is the relation between competition intensity and innovation?

Motivation II

- does more intense competition increase wages, reduce unemployment?
- do firms pollute more in a more competitive sectors?

Concentration I

- Concentration tends to measure competition correctly in response to a fall in entry barriers such that more firms are active in the market
- However, if competition intensity increases due to more aggressive interaction between firms (e.g. a minimum price is abolished)
  - inefficient firms may be forced out of the market
  - efficient firms gain market share at the expense of inefficient firms
- both effects tend to raise concentration
- Hence high concentration can be a signal of intense competition

Concentration II

- If Lance Armstrong wins the Tour de France 7 times in a decade, does it signal market power?
- Or is cycling very competitive and Armstrong better than the others?

Profits

- There is a tendency to equate competition with low profits
- First, note that even with perfect competition, firms can make positive profits (if costs are convex)
- Whereas Cournot competition is seen as less competitive than Bertrand competition, it is not hard to find examples where profits under Bertrand are higher than under Cournot competition
- Intuitively, more intense competition allows efficient firms to better leverage their advantage over inefficient firms
- In a cross section firms with high profits may simply be efficient but not have market power
- Although we look at profits as well, we do not consider profit *levels*

PCM I

- Conditional on cost, PCM is a measure of market power
- but conditional on price, it measures efficiency
- especially problematic in sectors where firms can innovate to reduce marginal costs
- Makes it impossible to interpret a firm's own pcm as a measure of market power for that firm
- Industry average PCM has a theoretical link with competition if pcm is weighted with firm's market share
- but then the *reallocation effect* can cause problems:
  - an increase in competition reallocates market share from inefficient firms (with low pcm) to efficient firms with (high pcm)

PCM II

  - hence an increase in competition intensity can raise industry average PCM

- New economy sectors with marginal costs close to zero: $pcm = (p - c)/p \approx 1$
- Many (new economy and network) sectors use two-part tariffs. Not clear how pcm should be extended to take this into account:
  - if one only considers the price at the margin, monopolist can have price equal to marginal cost and appropriates the whole consumer surplus using the fixed part of the tariff

Profit inequality I

- We say that a sector becomes more competitive if (for given cost distribution) the profit distribution becomes more unequal
- indeed, Bertrand competition leads to more inequality in profits than Cournot competition (although profit levels can go either way)
- environment A is more competitive than environment B if $\pi_A(c)$ is a convex transformation of $\pi_B(c)$
- Lorenz curve in environment A lies below Lorenz curve in B
- $-\pi''(c)/\pi'(c)$ increases with competition intensity (for all c)
  - is invariant to changes in measurement (euros, cents, dollars) and to changes in levels (say, each firm receives a fixed subsidy from the government and does not change its conduct)

Profit inequality II

- competition/inequality is related to the *curvature* of the profit function $\pi(c)$
- assume that the profit function takes the form:
  $\ln \pi_{it} = \alpha_i + \alpha_t - \beta_t \ln c_{it} + \varepsilon_{it}$
- $\beta = -d \ln(\pi)/d \ln(c)$: Profit Elasticity (PE):
  - percentage increase in profits due to a 1% fall in costs
- then $-\pi''(c)/\pi'(c) = \beta/c$: higher β signals more intense competition (higher profit inequality)
- comparative statics that give higher β include:
  - Cournot competition with a reduction in entry barriers (increasing the number of firms)
  - goods becoming closer substitutes
  - switching from Cournot to Bertrand competition
  - Hotelling model with a fall in travel cost

Data and estimation I

- We estimate PE for 139 Dutch industries in both manufacturing and services using firm level data (on average 87,000 firms per year)
- It turns out that on average PE equals 7 in the Netherlands: if costs per unit of output increase by 1%, profits fall by 7%
- We use firm level data from Statistics Netherlands (CBS)
- period: 1993-2002
- variable profits π_i are defined as: $revenues_i$ minus $variable\ costs_i$ where
- $variable\ costs =$
  $labor\ costs_i + energy\ costs_i + intermediate\ inputs_i$

Data and estimation II

- average variable costs c_i are defined as: *variable costs*$_i$/*revenue*$_i$
- as a robustness check we also use labor productivity as an efficiency measure
- we estimate the following equation for each industry and time period t:

$$\ln \pi_{it} = \alpha_i + \alpha_t - \beta_t \ln c_{it} + \varepsilon_{it}$$

- the firm (α_i) and time (α_t) fixed effects correct for some observational errors with respect to π_{it} and c_{it}

Frequency distributions PE

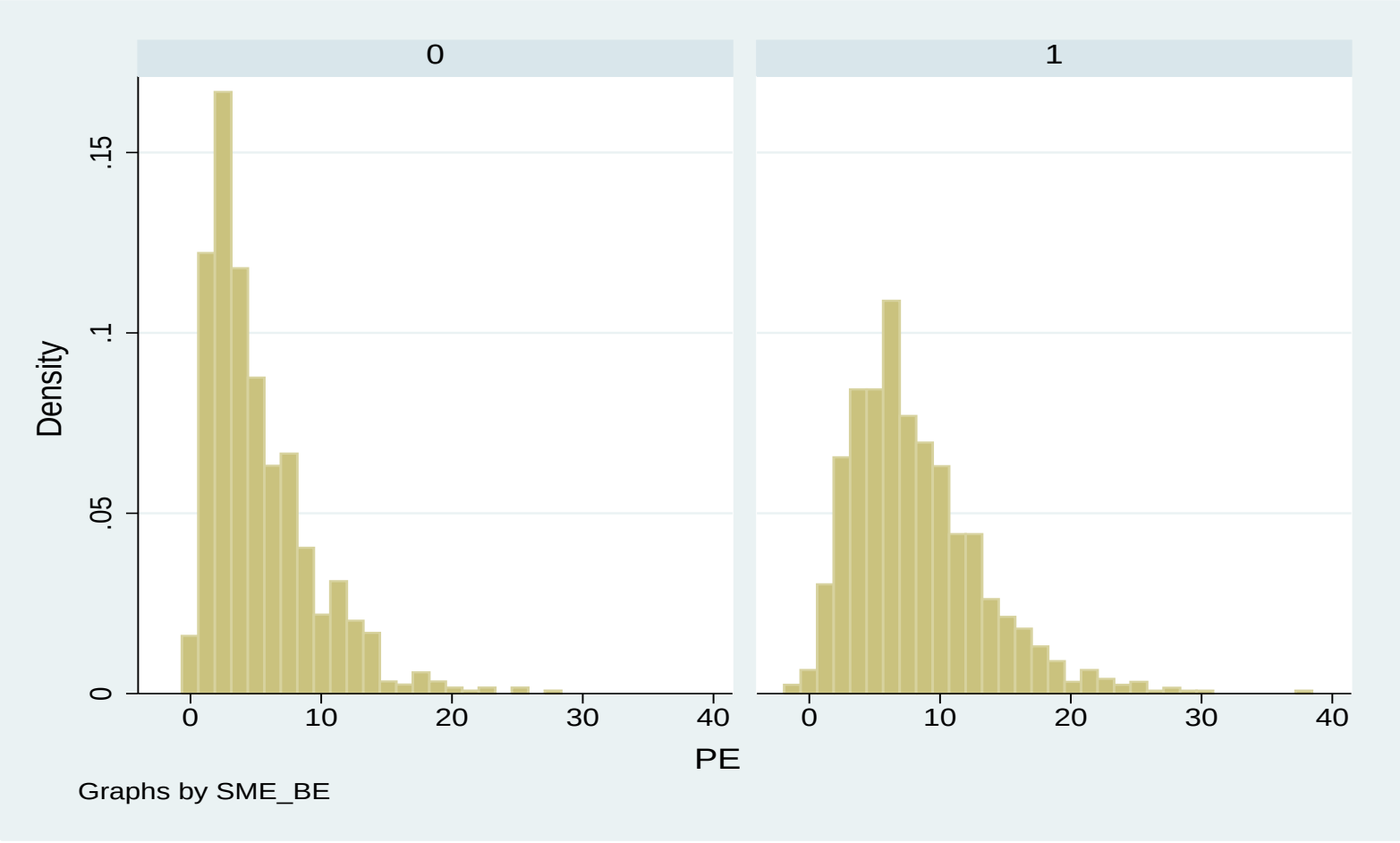


Figure: Distribution of PE in the Dutch economy.Left: SME, right: BE

Is the reallocation effect merely a theoretical possibility? I

- It turns out that on average PE and PCM are negatively correlated across industries and time periods:
  - as PE goes up and PCM goes down both indicate an increase in competition intensity
- Hence on average PE and PCM are consistent
- This does not imply that tracking an industry over time, PE and PCM always give the same message about the development of competition
- Over time for the same industry PE and PCM can move in the same direction: reallocation effect

Is the reallocation effect merely a theoretical possibility? II

- Industry average PCM is defined as:

$$PCM = \frac{\sum_{i=1}^{n}(p_i x_i - c_i x_i)}{\sum_{i=1}^{n} p_i x_i} = \sum_{i=1}^{n} \frac{p_i x_i}{\sum_j p_j x_j} pcm_i$$

- where $pcm_i = \frac{p_i - c_i}{p_i}$ is the price cost margin of firm i
- *Reallocation effect*: as competition intensifies (more aggressive conduct), market shares of efficient firms increase at the expense of inefficient firms
- This implies that concentration goes up, incorrectly indicating a fall in competition
- This shifts market share from firms with low pcm to firms with high pcm which can lead to an increase in industry average PCM; (incorrectly) indicating a fall in competition

Is the reallocation effect merely a theoretical possibility? III

- Suppose competition changes from $t = 0$ to $t = 1$:

$$PCM_1 - PCM_0 = \sum_{i \in I_1} ms_{i1} pcm_{i1} - \sum_{i \in I_0} ms_{i0} pcm_{i0} =$$

$$\sum_{i \in I} \{ \underbrace{ms_{i0}(pcm_{i1} - pcm_{i0})}_{\text{within effect}} + \underbrace{pcm_{i0}(ms_{i1} - ms_{i0})}_{\text{reallocation effect}}$$

$$+ \underbrace{(pcm_{i1} - pcm_{i0})(ms_{i1} - ms_{i0})}_{\text{interaction effect}} \}$$

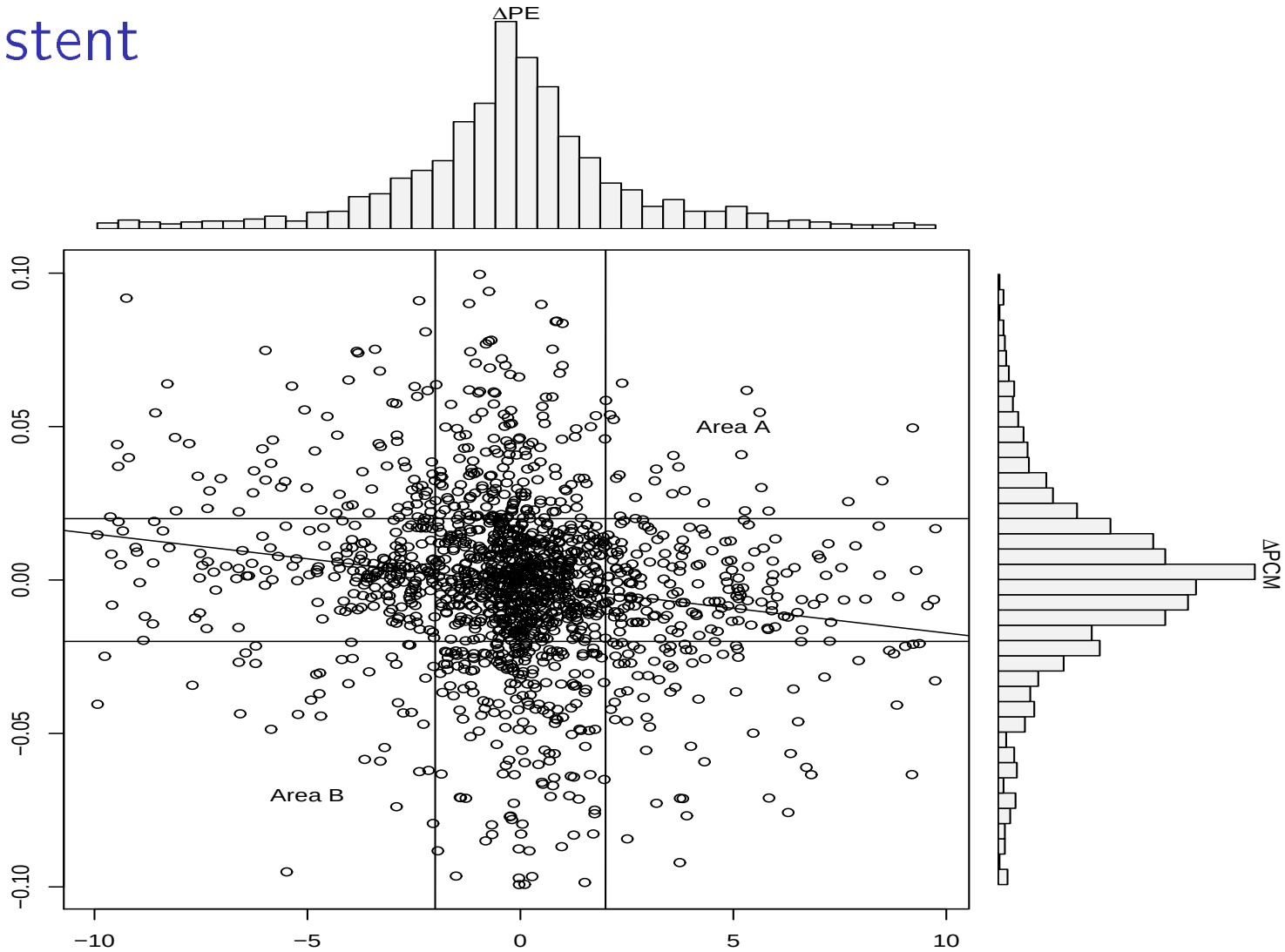
$$+ \underbrace{\sum_{i \in I_1 \setminus I} ms_{i1} pcm_{i1} - \sum_{i \in I_0 \setminus I} ms_{i0} pcm_{i0}}_{\text{change in active firms effect}}$$

- where $I_0(I_1)$ is the set of active firms before (after) the change in competition, $I = I_0 \bigcap I_1$ and $i \in I_1 \setminus I$ if both $i \in I_1$ and $i \notin I$

Is the reallocation effect merely a theoretical possibility? IV

- We expect the reallocation effect to be strong in markets where concentration is high

Focusing on the tails where ΔPCM and ΔPE are "very" inconsistent



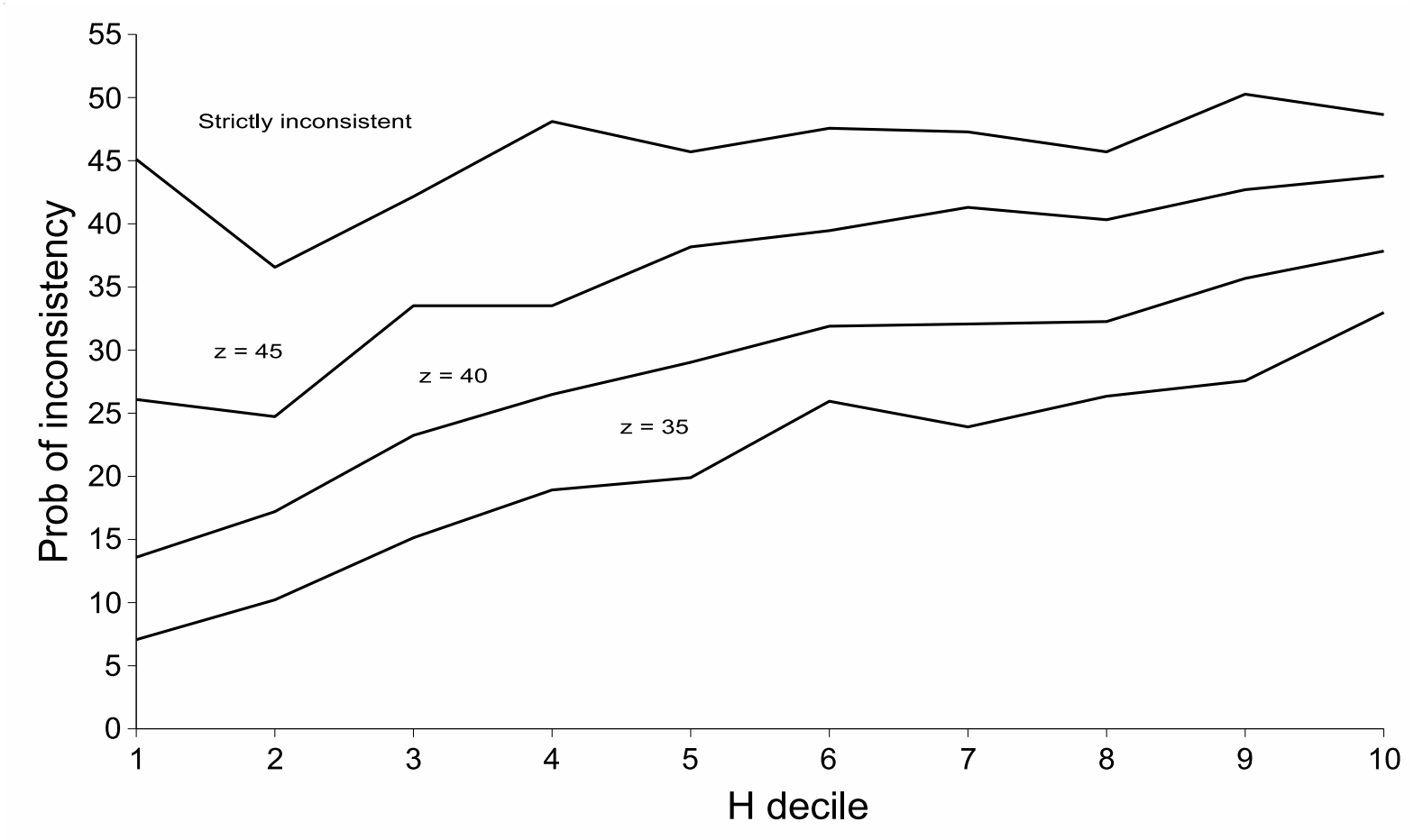
Predicting when PCM and PE are inconsistent

- We want to predict/explain when industries end up in the areas A or B
- We use a dummy for the empirical measure of the reallocation effect when it is big relative to PCM (below 25th or above 75th percentile)
- We estimate a fixed effects logit model explaining the probability that an industry ends up in the areas A or B (for different values of z)
- Higher concentration H implies higher probability of inconsistency; intuitively, with low concentration, reallocation effect is small as well

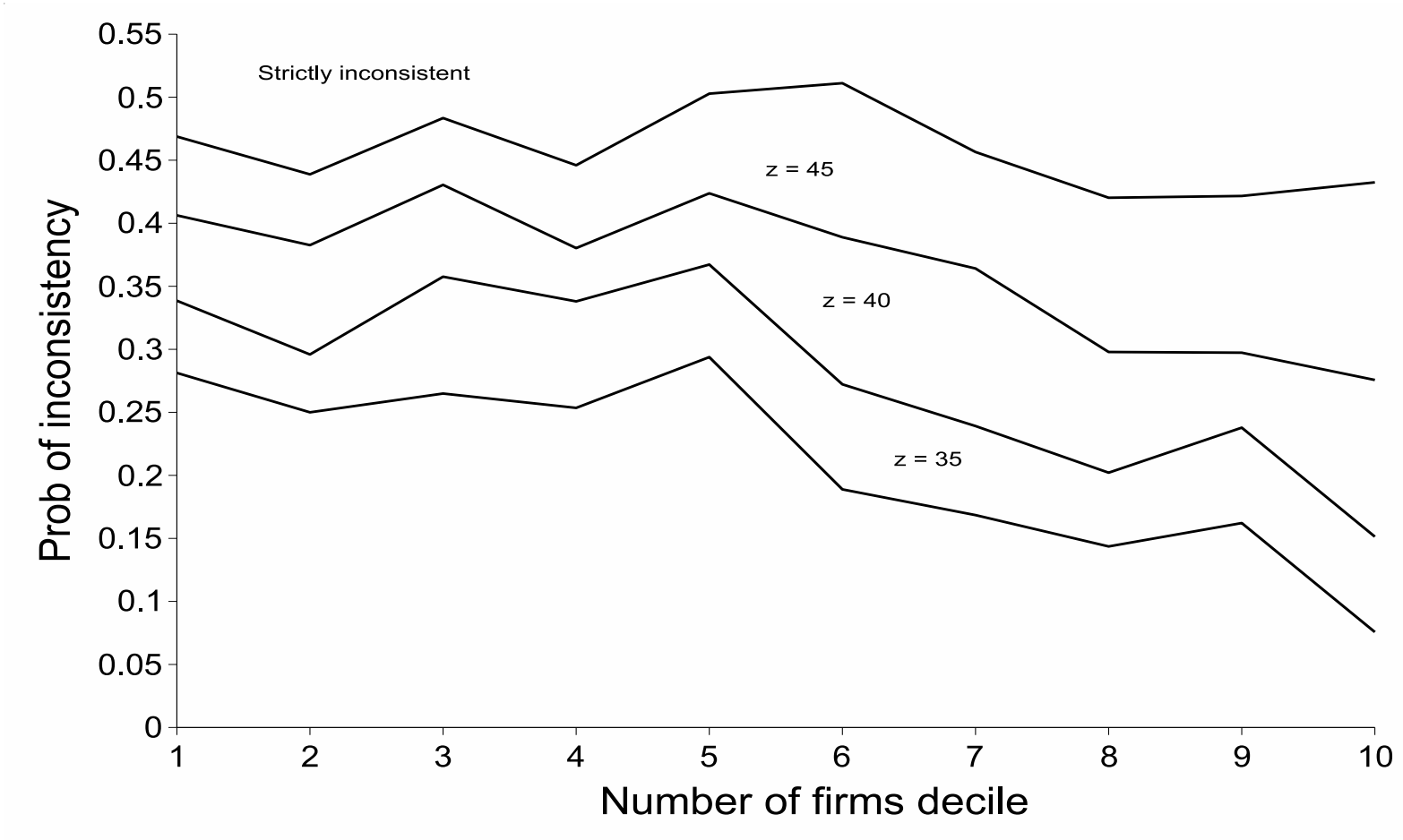
Probability of inconsistency between ΔPE and ΔPCM

	H-index	Big reall. effect	Numb. of firms	% inconsistent
Strictly	0.60 (1.7)*	–	–	
inconsistent	0.59 (1.6)	0.06 (0.8)	–	
	0.33 (0.7)	0.06 (0.7)	-0.03 (0.9)	45.7
$z = 45$	1.52 (3.7)**	–	–	
	1.48 (3.6)**	0.16 (1.6)	–	
	0.70 (1.4)	0.15 (1.5)	-0.08 (2.2)**	36.4
$z = 40$	2.17 (5.0)**	–	–	
	2.12 (5.0)**	0.25 (2.4)**	–	
	0.91 (1.8)*	0.23 (2.3)**	-0.14 (3.3)**	27.9
$z = 35$	2.85 (6.3)**	–	–	
	2.79 (6.5)**	0.44 (3.9)**	–	
	1.53 (2.9)**	0.42 (3.7)**	-0.15 (4.3)**	20.8

Probability of inconsistency as a function of deciles of the H-index



Probability of inconsistency as a function of deciles of the number of firms in the market



Conclusion I

- When thinking about competition, do not blindly use PCM and concentration:
  - the reallocation effect plays a role in concentrated sectors
  - an increase in concentration and industry average PCM can be caused by an increase in competition intensity
- Do not focus on profit levels: the profits of an efficient firm can increase in response to an increase in competition intensity because it can use its cost advantage more aggressively
- Think in terms of profit inequality:
  - policy measures that raise the profits of efficient firms relative to inefficient firms increase profit inequality and hence are pro-competitive
- Not all increases in competition are welfare enhancing:

Conclusion II

- if (currently) incumbents are more efficient than entering firms, the use of exclusive contracts can raise the profits of incumbents at the expense of entrants
- (consumer) welfare maximizing competition intensity may not be perfect competition
- e.g. dynamic industries where innovation is important should be less competitive than static industries