Consistent Good News and Inconsistent Bad News

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News is more convincing when it is more consistent

How much we update our beliefs upon seeing news/data depends on how noisy we believe the data is

- We are often unsure of the amount of noise in the data and estimate noise using the data sample itself

Suppose I'm a manager of multiple projects and I want you to update positively on my managerial skill

- If performance news is generally good, I want to make the news look more consistent across projects
- If performance news is generally bad, I want to make the news look less consistent across projects

Preview of theory

Bayesian framework in which receivers aren't sure of precision of news

Explore sender incentives to distort news subject to constraints

- If generally good news, improve worst news
- If generally bad news, improve best news

Generates sender preferences over the mean and variance of news that differ from standard mean-variance preferences

- More variable news sometimes helps
- Better news sometimes hurts

Solve for equilibrium with naive or sophisticated receivers

- Like standard signal jamming models, but with partial pooling and information loss

Preview of empirical tests

Managers of conglomerate firms report performance across business segments

- Managers can distort the consistency of reported segment earnings using discretion over the allocation of shared costs
- We find that reported segment earnings are more consistent when overall firm news is good and less consistent when firm news is bad

The variance of news may be higher during bad times for other reasons

- Don't find the same patterns for:
  - Segment **sales** (reported prior to the deduction of allocated costs)
  - Matched segments based on industry
- Not driven by conservatism, write-downs, proprietary costs

Broader implications

Aside from blatant fraud, theory applies to many forms of persuasion / news distortion

- **Effort allocation**
- **Media spin and contrarian news distortion**
- **Too good (or bad) to be true**: Dawid 1973, O'Hagan 1979, Subramanyan 1996, Kirschenheiter and Melumad 2002
- **Empirical persuasion**: p-hacking, selection of robustness tests

Model framework

True state of the world q is uncertain

- Prior $f(q)$ known by sender and receiver
- Prior estimate is $E[q]$

Sender learns signals/news: $x = (x_1, \ldots, x_n)$, **with** $x_i = q + \varepsilon_i$

- Sender may or may not know q
- Both know noise iid, $\varepsilon_i \sim N(0, \sigma_\varepsilon^2)$
- But variance of noise uncertain, $\sigma_\varepsilon^2 \sim H$

Let $\overline{x}$ be the mean of the news s be the s.d.

- Receiver takes action increasing in $E[q|\overline{x}, s]$
- Sender wants a higher action, so U increasing in $E[q|\overline{x}, s]$
- Can write sender utility as $U(\overline{x}, s)$

Consistency of the news

Let $g(\overline{x} - q|s)$ be the distribution of mean news

If news is good ($\overline{x} > E[q]$), sender wants the news to be more persuasive

- Lower s should imply $\overline{x}$ is more precise signal of q
- More precise signal of q should raise $E[q|\overline{x}, s]$ more

If news is bad ($\overline{x} < E[q]$), sender wants the news to be less persuasive

- Higher s should imply $\overline{x}$ is less precise signal of q
- Less precise signal of q should lower $E[q|\overline{x}, s]$ less

Prove these intuitions formally in paper

What if we can distort the news?

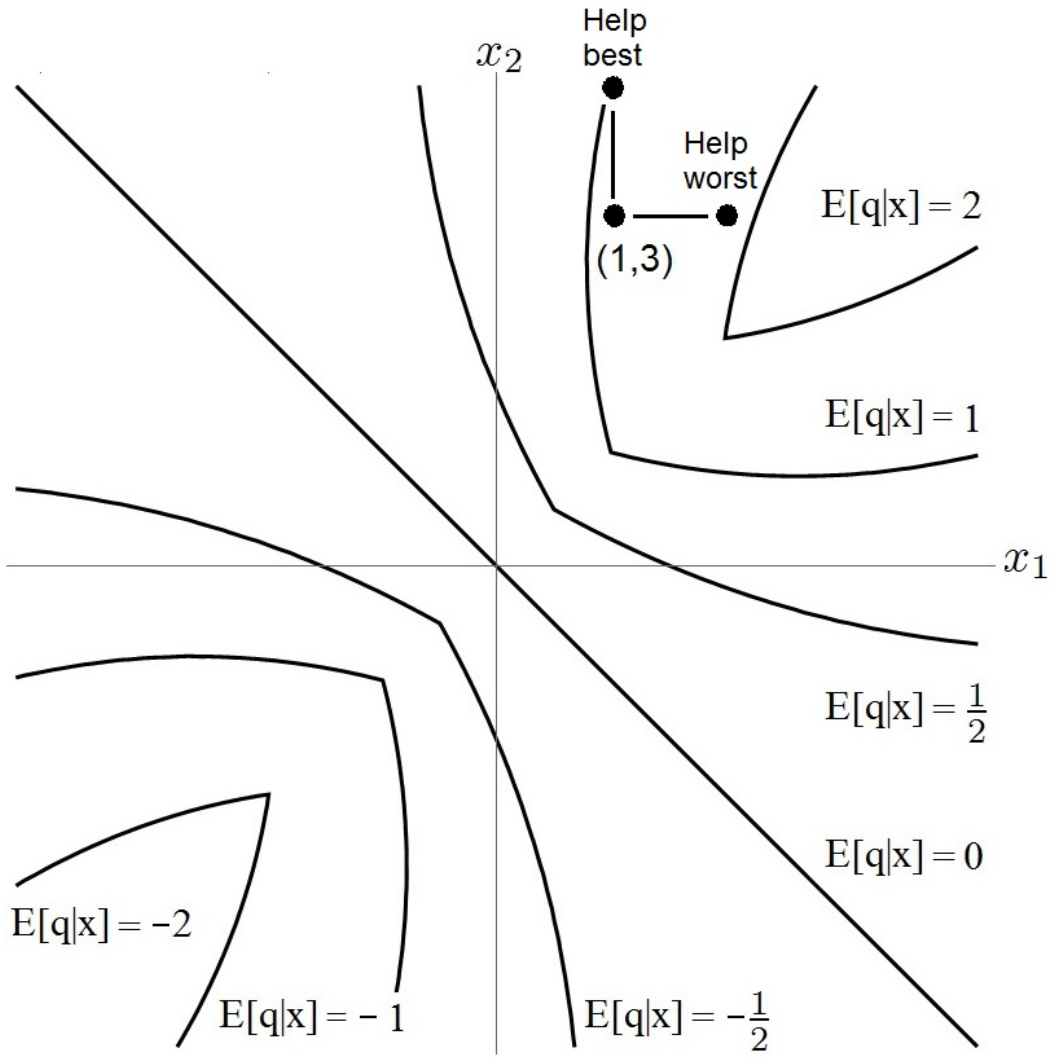
What distortions have the biggest effect?

$$\frac{d\overline{x}}{dx_i} = \frac{1}{n}, \quad \frac{ds}{dx_i} = \frac{x_i - \overline{x}}{(n-1)s}$$

- Raising any piece of news increases $\overline{x}$ the same
- Raising the lowest news decreases s the most
- Raising the best news increases s the most
- So raise lowest if $\overline{x} > E[q]$ and highest if $\overline{x} < E[q]$

Suppose can shift news by one unit

Example: $f \sim N(0,2)$, $h = 1/\sigma_\varepsilon^2$ and $n = 2$



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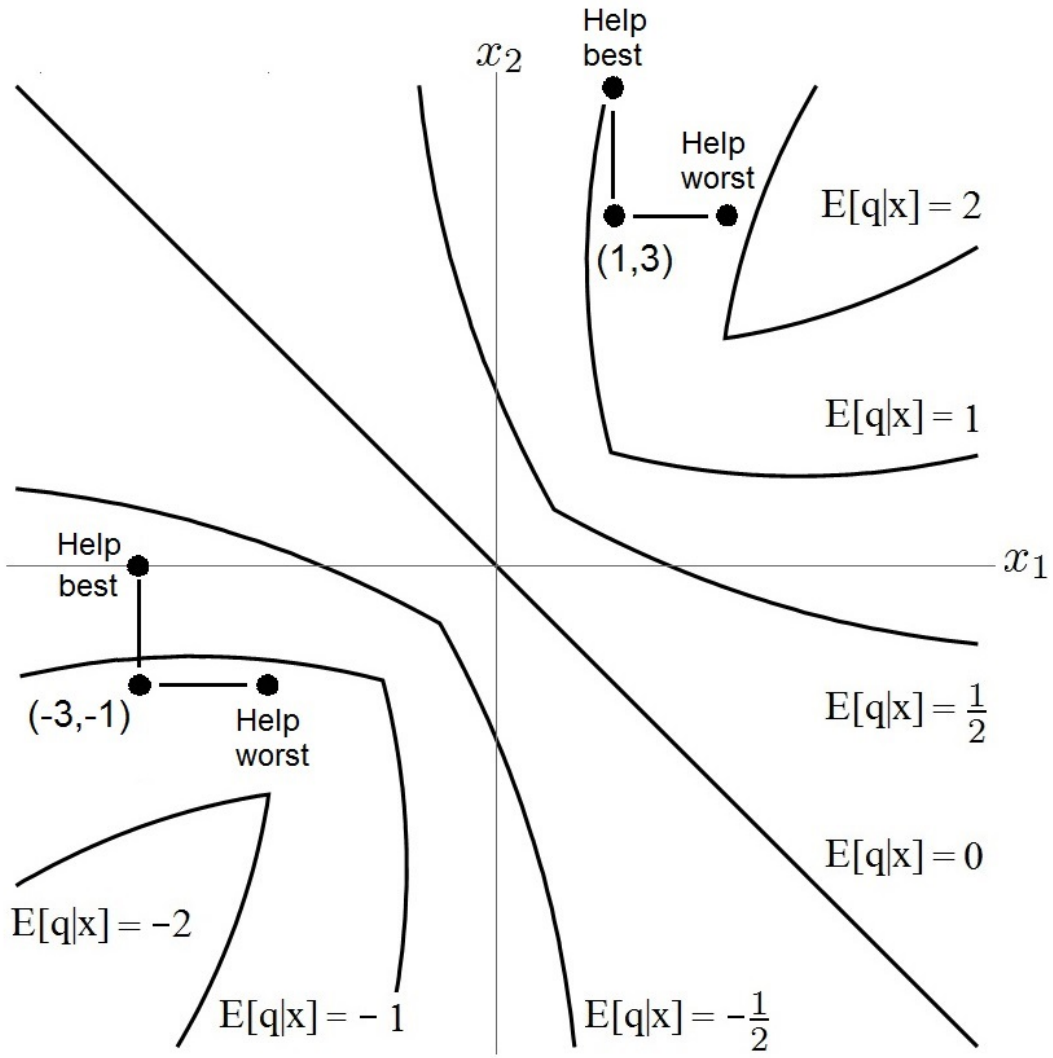
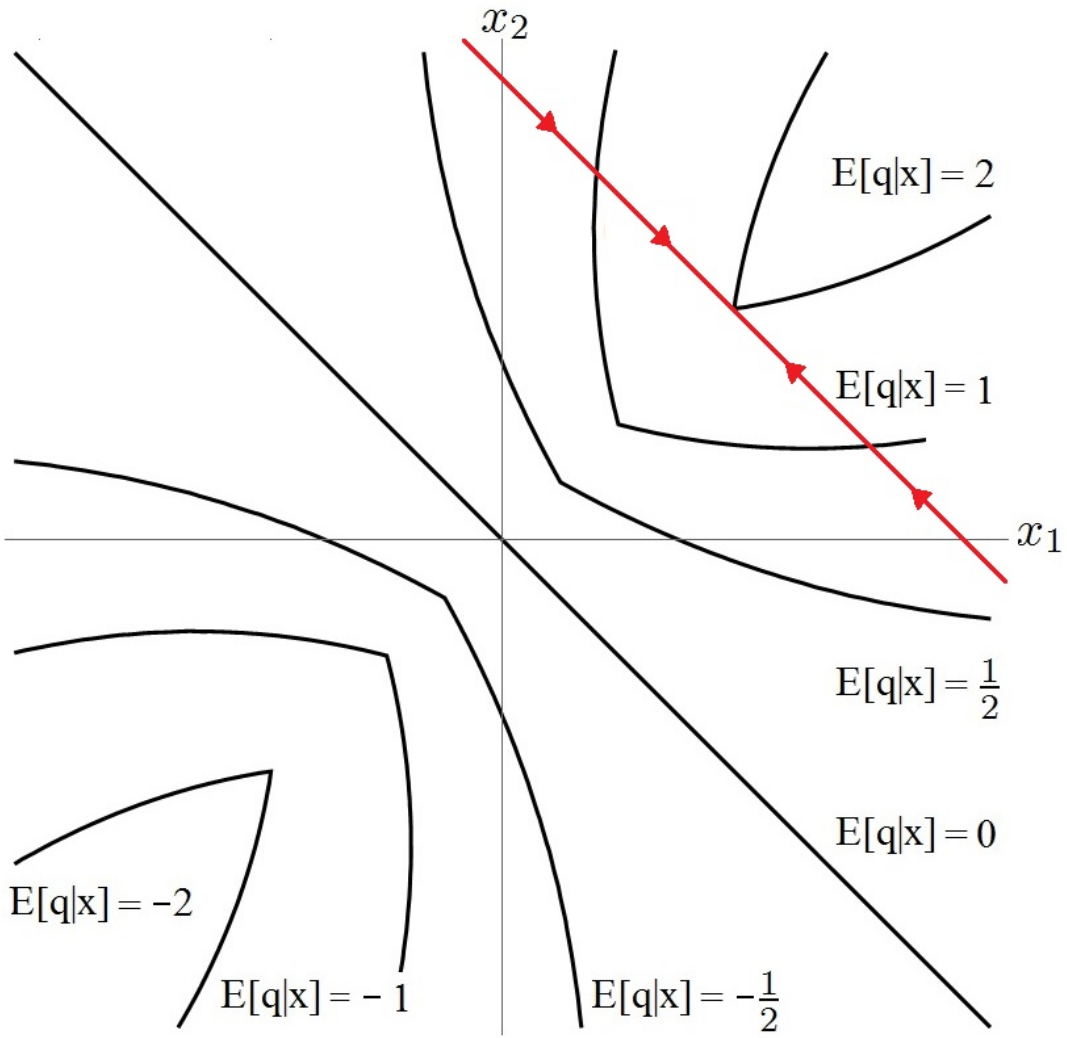


Equilibrium news distortion subject to constraints

Sender-receiver game, but first suppose naive receivers

- Distortion from x to $\widetilde{x}$ is costless
- Constant mean so $\sum_i \widetilde{x}_i - x_i = 0$
- Maximum distortion d so $\sum_i |\widetilde{x}_i - x_i| \leq d$
- Distributions f, g, and h are common knowledge

Suppose $d = 1, \overline{x} = 2$



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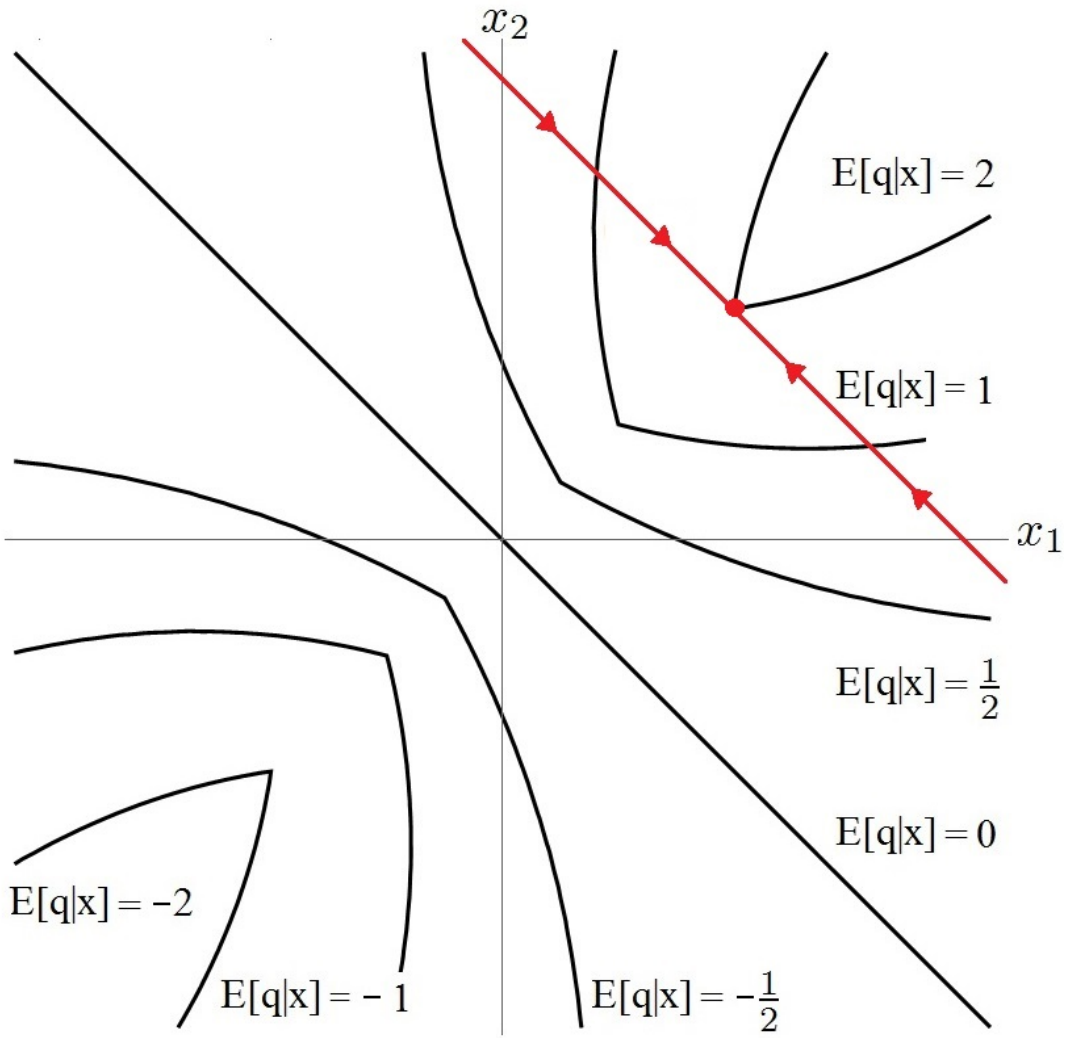

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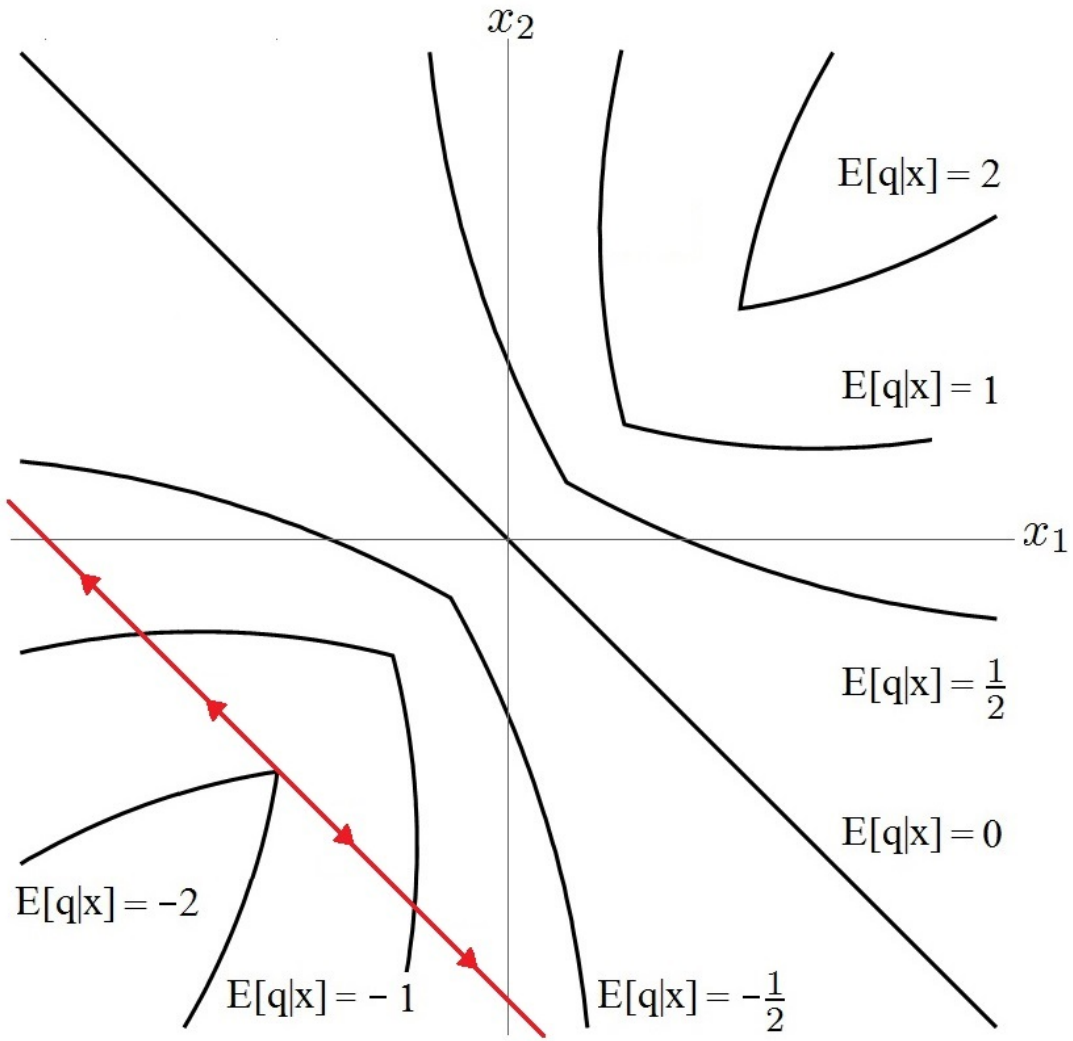

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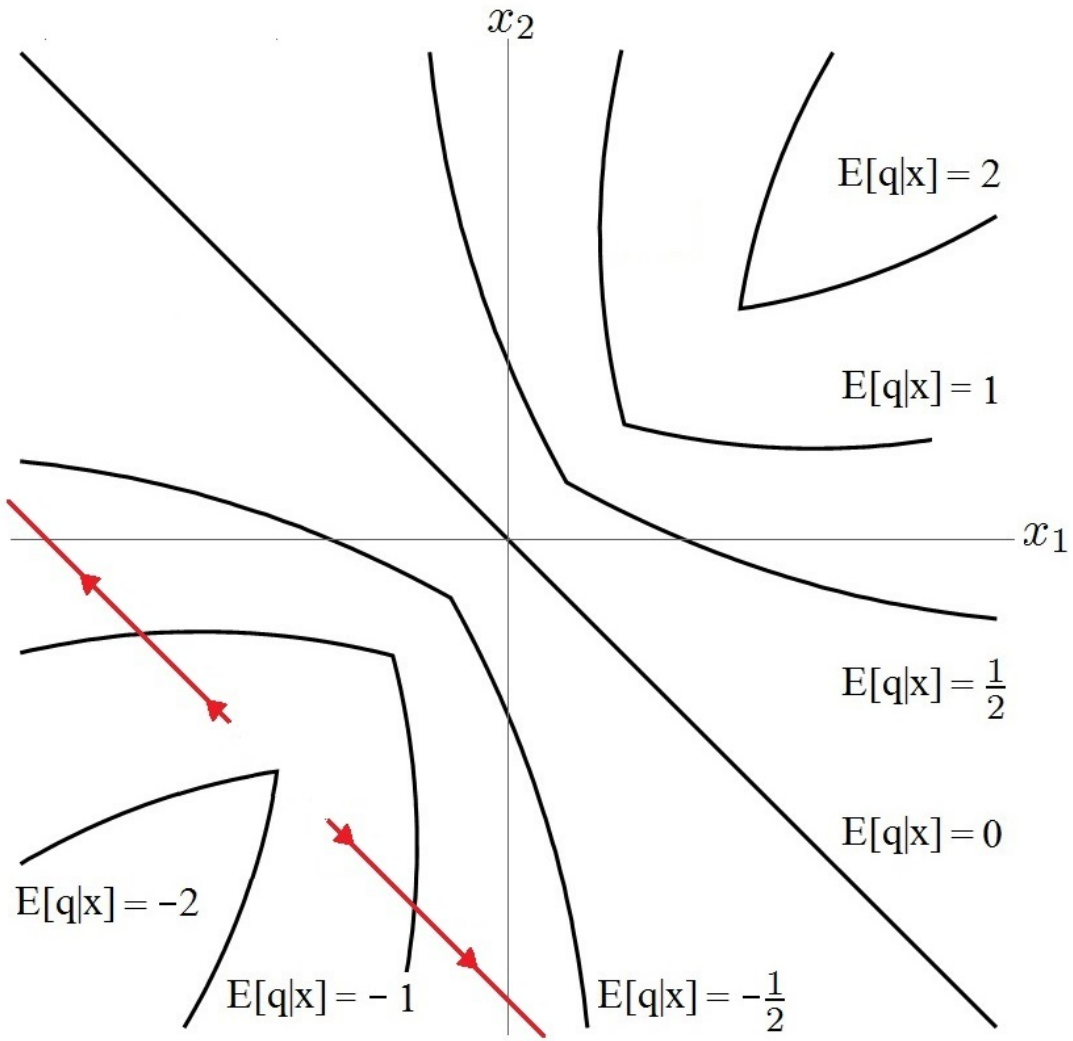

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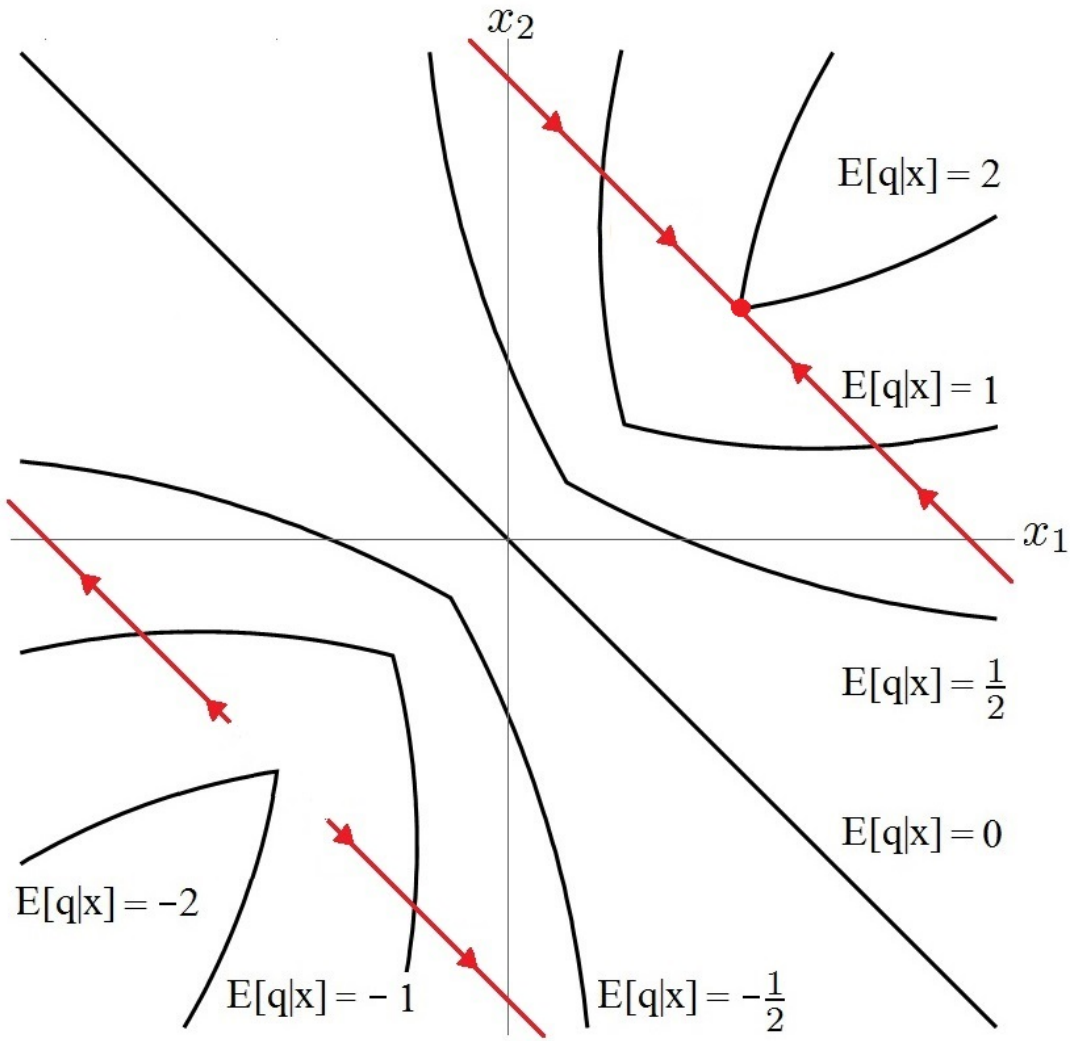


What if the receiver has rational expectations (PBE)?

Suppose sender distorts news as in the case with naive receivers

If $\widetilde{x}$ in range where strategy $\widetilde{x}(x)$ is one-to-one

- Receiver inverts back true x from $\widetilde{x}$

If $\widetilde{x}$ in range where pooling

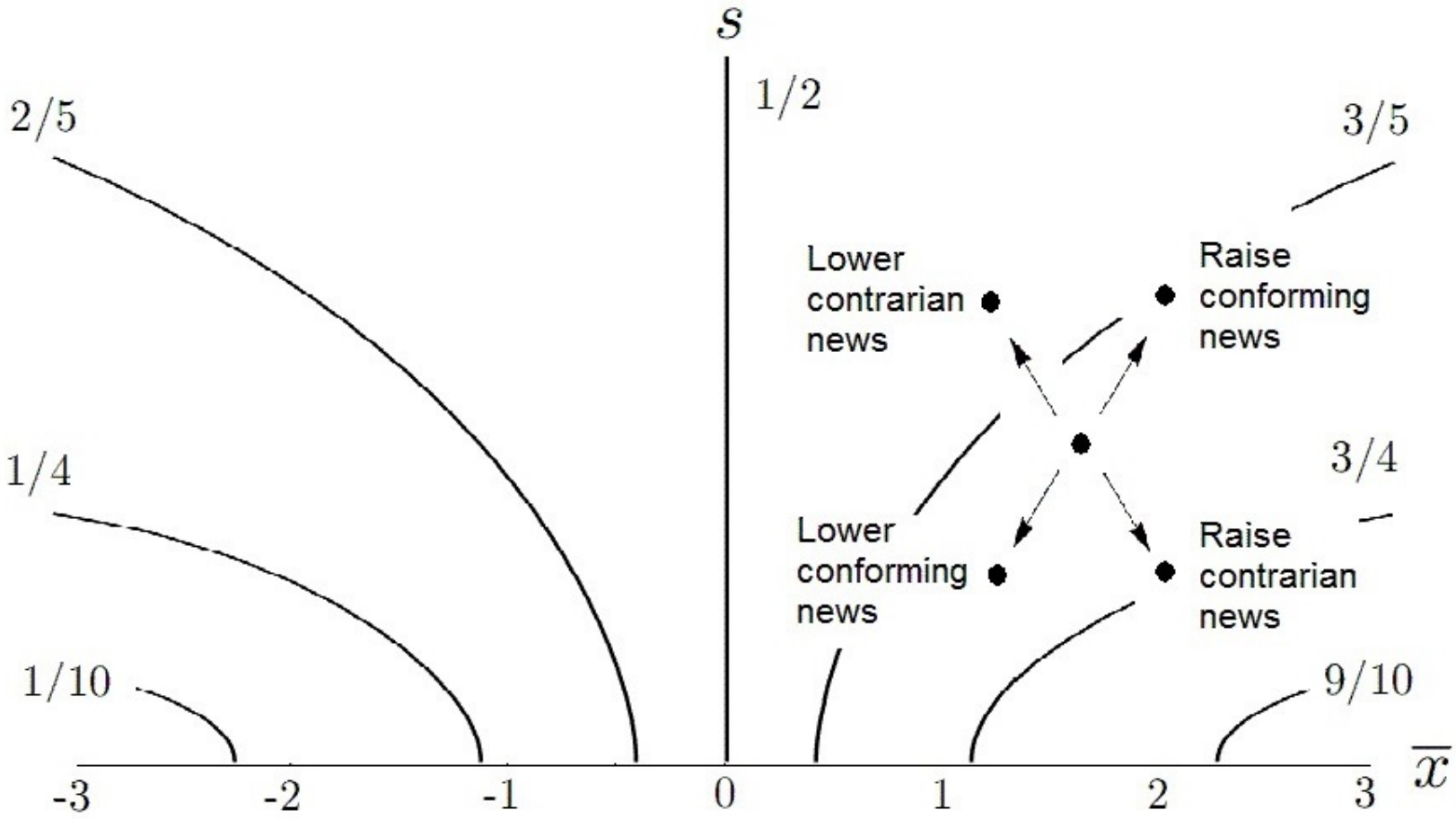
- Receiver weights the possible types based on distributions
- Some loss in information

If reported $\widetilde{x}$ is off the equilibrium path

- Apply D1 refinement – receiver beliefs put all weight on type who would deviate for largest set of rationalizable payoffs

No type has an incentive to deviate given these beliefs

Extension: Contrarian news distortion



Both sides of a debate should focus on distorting "contrarian news" (pieces of news on the prior's side of $\overline{x}$)

Test model predictions using segment earnings

Model prediction: $\widetilde{s} < s$ **for** $\overline{x} > E[q]$ **and** $\widetilde{s} > s$ **for** $\overline{x} < E[q]$

The manager simultaneously reports earnings for each segment

- Segment earnings (profits) = sales - costs
- Managers can flexibly allocate shared costs across segments

Segment earnings are an important source of firm news

- Epstein and Palepu (1999) survey of 140 star sell-side analysts: Segment performance data is the most useful data for their investment decisions, followed by the three financial statements

Relation to the model

We model distortion under a fixed mean and total distortion constraint

- Total earnings are approximately fixed each period and managers can allocate a limited amount of costs flexibly across segments

Unlike manipulation of total firm earnings over time, distorting consistency of segment earnings does not directly limit distortion next period

- Of course, dynamic considerations may still apply
- We abstract away from dynamic concerns and consider a manager who wants to improve short-run perceptions of her managerial ability, e.g., to improve the probability of receiving an outside offer

Emphasis on consistency or inconsistency

Good news

- Walmart Q2 2015: *Each of our segments contributes to the Company's operating results differently, but each has generally maintained a* ***consistent*** *contribution rate to the Company's net sales and operating income.*

Bad news

- HP Q3 2015 (after negative performance in 5 out of 6 segments): *HP delivered results in the third quarter that reflect very strong performance in our Enterprise Group.*

Measures of segment and firm news

- Compustat segments data: Segment i in firm j in year t
- Scaled earnings (ROA): Commonly used and comparable across firms and segments of different sizes

$$\text{segment news } x_{ijt} \equiv \frac{e_{ijt}}{a_{ijt}}$$

- Let $\overline{x}_{jt}$ and s_{jt} be the weighted mean and s.d. of x_{ijt}
  - Weight by relative segment sizes $\frac{a_{ijt}}{A_{jt}}$
  - Model predictions extend to a setting with weights
- $\overline{x}_{jt}$ equals firm-level ROA, which remains constant if costs are shifted across segments

A benchmark null hypothesis

Model prediction: s_{jt} lower when $\overline{x}_{jt}$ is good news

But consistency may vary with firm-level news for other natural reasons

- Bad times may just be more volatile

Many alternative explanations should also apply to segment sales

- Sales are reported prior to the deduction of costs
- Leads to a *conservative benchmark*: Managers can still distort the consistency of segment sales through transfer pricing or the targeted allocation of effort and resources

A benchmark null hypothesis (continued)

Compare the consistency of reported segment earnings to a benchmark consistency of earnings implied by segment-level sales data

Proportional costs assumption:

- Absent distortions, total costs are associated with segments according to the relative levels of sales for each segment

Can also use

- **Industry adjusted assumption**
- **Average costs over time assumption**

Regression specification

$$s_{jt} - \widehat{s_{jt}} = \beta_o + \beta_1 I_{jt}^{goodnews} + controls + \varepsilon_{jt}$$

- $s_{jt} - \widehat{s_{jt}}$: abnormal s.d. of segment earnings
- $I_{jt}^{goodnews}$: firm earnings exceeds level in the previous year
- **Null hypothesis is $\beta_1 = 0$: Prediction error is uncorrelated with whether firm news exceeds expectations**
- **Model predicts $\beta_1 < 0$: Abnormal s.d. of segment earnings is lower when firm news is good**

Consistency of segment earnings

	SD Earnings	SD Sales	Abnormal SD Earnings	
	(1)	(2)	(3)	(4)
Good firm news	-0.0975***	0.0146	-0.111***	-0.0884***
	(0.0150)	(0.0138)	(0.0179)	(0.0198)
Cost assumption			Prop	Ind adj
Control for mean	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R^2	0.0643	0.129	0.179	0.0231
Obs	23276	23276	23276	23276

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- Columns 3 & 4: Good firm news (when firm earnings exceeds the level in the previous year) corresponds to a 9-11% decline in the s.d. of segment earnings
- Similar results if news x_{ijt} is measured as segment earnings relative to industry mean

Placebo test: Consistency of matched segment earnings

- For each segment-year corresponding to a multi-segment firm, we match to a single segment firm
  - Same year and SIC2 industry
  - Nearest neighbor in terms lagged EBIT, assets, and sales

- Matched placebo firms mechanically cannot shift resources across segments

- If our results are driven by industry trends among connected segments during good vs. bad times, we should find similar results with matched placebo segments

Placebo test: Consistency of matched segment earnings

	SD Earnings	SD Sales	Abnormal SD Earnings	
	(1)	(2)	(3)	(4)
Good firm news	0.0232	0.00911	0.0176	0.0287
	(0.0184)	(0.0166)	(0.0222)	(0.0244)
Cost assumption			Prop	Ind adj
Control for mean	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R^2	0.0119	0.0825	0.211	0.0353
Obs	17192	17191	17192	17192

The s.d. of matched segment earnings and sales do not vary significantly with firm-level news

Other determinants of earnings reporting?

- **Conservatism, impairments/write-downs**: Cost shock to one segment can increase s and lower $\overline{x}$
- **Proprietary costs**: Hiding good performance in one segment to avoid competition may lead to a negative relation between $\overline{x}$ and s

	Abnormal SD Earnings					
	(1)	(2)	(3)	(4)	(5)	(6)
Good firm sales news	-0.171***	-0.128***				
	(0.0237)	(0.0285)				
Good firm news (excl worst perf seg)			-0.0914***	-0.0714***		
			(0.0198)	(0.0221)		
Good firm news (excl best perf seg)					-0.150***	-0.124***
					(0.0183)	(0.0199)
Cost assumption	Prop	Ind adj	Prop	Ind adj	Prop	Ind adj
Control for mean	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.179	0.0234	0.178	0.0226	0.186	0.0277
Obs	23276	23276	23276	23276	23276	23276

But, similar relation between s and firm-level news when the measure of firm news is not related to a negative cost shock or performance in the best segment

Heterogeneity

Effects are stronger for managers at the start of their tenure

Effects are stronger for firms with larger distortion budgets

- Measure distortion budget as the average ratio of costs to sales for the firm over time
- Use within-firm-over-time variation in good firm news

Robustness

- Average costs assumption: Test whether cost allocations differ from the within-firm mean over time in a manner predicted by the model
- Sales are bounded below by zero, which may compress the s.d. of sales, particularly during bad times. We find similar results after restricting the sample to observations in which the minimum level of segment sales is above the 25th percentile in each sample year
- Alternative measures of good firm news, or within firm over time
- Before and after passage of SFAS No. 131, which increased the prevalence of segment reporting
- Similar results if the sample is restricted to firms without a headquarters or "unallocated" segment (no significant differences)

Conclusion

Biased senders distort data to send consistent good news and inconsistent bad news

- Test model predictions using segment earnings reports

Other applications?

- Allocation of effort / resources across projects
- Media bias: Spin most or least favorable evidence for your position?
- Bayesian persuasion: (e.g. Gentzkow and Kamenica 2011)
  - Know that $q > E[q]$ – choose tests with less noise

Are we in a sophisticated or naive equilibrium?