Implications of Overconfidence on Information Investment

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Is Overconfidence Bad or Good?

Forbes SEP 19, 2011 @ 11:29 AM   12,780 ⦿

The Benefits and Danger of Over-Confidence

BBC capital

The trouble with being too confident

By Sydney Finkelstein
27 May 2015

TIME CAREER STRATEGIES
You Gotta Have Faith: Why Overconfidence Can (Sometimes) Be Good for You
By David Futrelle | July 13, 2012

NATIONAL GEOGRAPHIC

Evolution of Narcissism: Why We're Overconfident, and Why It Works

Overestimating our abilities can be a strategy for success, model shows.

By **Christine Dell'Amore**, for National Geographic News

PUBLISHED SEPTEMBER 16, 2011

Outline

1. Model of *overconfidence as misperception of info precision* $\Rightarrow$ three forces that arise from overconfidence:
   $\uparrow$ overconfidence $\Rightarrow$ force 1 increases info investment, force 2 and 3 decrease it
2. Given the level of overconfidence, can we change the incentives to improve the outcome?

Literature Review

1. Overconfidence as correlation neglect:
   Ortoleva and Snowberg (2015), Levy and Razin (2015), Glaeser and Sunstein (2009)
2. Overconfidence as overesimation of one's ability:
   Heidhues, Koszegi and Strack (2015)
3. Overconfidence as overprecision, with <u>no</u> option to choose the amount of information to collect:
   Scheinkman and Xiong (2003), Kyle, Obizhaeva and Wang (2017)

This paper: overconfidence as overprecision, <u>with</u> the option to choose the amount of information to collect

PART 1. MODEL OF OVERCONFIDENCE

Leading example

A judge decides whether to acquit or convict a defendant who can be either innocent or guilty.

Research question

How does overconfidence influence the quality of the verdict?

Moore and Healy (2008): Three Types of Overconfidence

Overestimation of one's actual performance, *I did it great!*

Overplacement of one's performance relative to others, *I did it better than others!*

Overprecision in one's beliefs, *I know everything!*

Moore and Healy (2008): Three Types of Overconfidence

Overestimation of one's actual performance, *I did it great!*

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Overprecision in one's beliefs, *I know everything!*

This paper

The judge believes that he has access to information that is *more precise than it actually is*

▶ by consuming this information, he becomes overconfident in his beliefs $\longrightarrow$ *overprecision*

▶ by overestimating the precision of available information, he overestimates his ability to process this information $\longrightarrow$ *overestimation*

Model

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- Unbiased judge:
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  - utility from acquitting guilty = utility from convicting innocent
- Info: Brownian motion with state-dependent drift

$$dX_t = \mu_z dt + \sigma dW_t, \quad \mu_z = \begin{cases} 1, & z = \text{Innocent} \\ -1, & z = \text{Guilty} \end{cases}$$

  - judge chooses the stopping time τ
  - cost $= \kappa \cdot \tau$
  $$u(\text{verdict}, z) - \kappa\tau$$

The judge observes

$$dX_t = \mu_z dt + \sigma dW_t, \quad \mu_z = \begin{cases} 1, & z = \text{Innocent} \\ -1, & z = \text{Guilty} \end{cases}$$

Definition
Overconfidence = distortion in perceived variance of the signals: the judge believes $\tilde{\sigma}^2$ instead of σ^2

$$\frac{\sigma^2}{\tilde{\sigma}^2} : \quad \text{the level of overconfidence}$$

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Definition
Overconfidence = distortion in perceived variance of the signals: the judge believes $\tilde{\sigma}^2$ instead of σ^2

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Question
How does overconfidence influence the quality of the verdict?

or equivalently

How does the expected stopping time change with the perceived variance $\tilde{\sigma}^2$?

Strategy space	Tradeoff	Result

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binary: $\tau \in \{0, T\}$ *Ex: hold trial or not*		
continuous: $\tau \geq 0$ *Ex: decide ex ante how long trial will be*		

function:
    choose τ
    dynamically
 	
Ex: decide during trial when to stop it		

Strategy space	Tradeoff	Result
binary: $\tau \in \{0, T\}$ *Ex: hold trial or not*	**Force 1** variance $\downarrow \Rightarrow$ signal is more precise $\Rightarrow$ WTP for signal $\uparrow \Rightarrow$ **more information**	overconfidence $\uparrow \Rightarrow$ $\mathbb{E}\left[\tau\right] \uparrow$

Strategy space	Tradeoff	Result

binary: $\tau \in \{0, T\}$
 	
Ex: hold trial or not
	Force 1 variance $\downarrow \Rightarrow$
	  signal is more precise $\Rightarrow$
	  WTP for signal $\uparrow \Rightarrow$
	    more information
		overconfidence $\uparrow \Rightarrow$
		$\mathbb{E}[\tau] \uparrow$

continuous: $\tau \geq 0$
 	
Ex: decide ex ante
how long trial will be
	Force 1
	Force 2 variance $\downarrow \Rightarrow$
	  already collected info
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	    less information	

Strategy space	Tradeoff	Result
binary: $\tau \in \{0, T\}$ *Ex: hold trial or not*	**Force 1** variance $\downarrow \Rightarrow$ signal is more precise $\Rightarrow$ WTP for signal $\uparrow \Rightarrow$ **more information**	overconfidence $\uparrow \Rightarrow$ $\mathbb{E}[\tau] \uparrow$
continuous: $\tau \geq 0$ *Ex: decide ex ante* *how long trial will be*	**Force 1** **Force 2** variance $\downarrow \Rightarrow$ already collected info is more precise $\Rightarrow$ **less information**	$\exists$ optimal level of overconfidence $\mathbb{E}[\tau] \uparrow$ below it $\mathbb{E}[\tau] \downarrow$ above it

Strategy space	Tradeoff	Result

binary: $\tau \in \{0, T\}$
 	
Ex: hold trial or not
	Force 1 variance $\downarrow \Rightarrow$
	  signal is more precise $\Rightarrow$
	  WTP for signal $\uparrow \Rightarrow$
	    more information
		overconfidence $\uparrow \Rightarrow$
		$\mathbb{E}[\tau] \uparrow$

continuous: $\tau \geq 0$
 	
Ex: decide ex ante
how long trial will be
	Force 1
	Force 2 variance $\downarrow \Rightarrow$
	  already collected info
	  is more precise $\Rightarrow$
	    less information
		$\exists$ optimal level
		  of overconfidence
		$\mathbb{E}[\tau] \uparrow$ below it
		$\mathbb{E}[\tau] \downarrow$ above it

function:
  choose τ
  dynamically
 	
Ex: decide during
trial when to
stop it
	Force 1+Force 2
	Force 3 perceived
	  variance $\downarrow \Rightarrow$
	  unexpected noise
	  treated as
	  meaningful signal $\Rightarrow$
	  stop sooner than
	  expected $\Rightarrow$
	    less information	

Strategy space	Tradeoff	Result

binary: $\tau \in \{0, T\}$
 	
Ex: hold trial or not
	Force 1 variance $\downarrow \Rightarrow$
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	    more information
		overconfidence $\uparrow \Rightarrow$
		$\mathbb{E}[\tau]$ $\uparrow$

continuous: $\tau \geq 0$
 	
Ex: decide ex ante
how long trial will be
	Force 1
	Force 2 variance $\downarrow \Rightarrow$
	  already collected info
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		$\exists$ optimal level
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		$\mathbb{E}[\tau]$ $\uparrow$ below it
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function:
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Ex: decide during
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	    less information
		overconfidence $\uparrow \Rightarrow$
		$\mathbb{E}[\tau]$ $\downarrow$
		
		Force 3: excess sensitivity
		  to noise
		$\Rightarrow$ *strong when*
		  little info collected

PART 2. OPTIMAL CONTRACT FOR OVERCONFIDENT AGENT

Assumption

The principal knows the level of overconfidence of the agent

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- ▶ contract = M: M∈{dynamic model, static model}
  Should we restrict the judge to commit to the length of the trial in advance?
- ▶ contract = (M,Q): Q is the agent's payoff benefit from the correct verdict
  What if we can also choose how much to pay to the agent?

Dynamic vs Static Models

Goal: compare Prob(correct decision|dynamic model)$\equiv \Pi^D$ vs
Prob(correct decision|static model)$\equiv \Pi^C$

- ▶ if the agent is rational, dynamic model is better
- ▶ dynamic model brings force 3 that decreases the probability of the correct decision

Dynamic vs Static Models

Goal: compare Prob(correct decision|dynamic model)$\equiv \Pi^D$ vs
Prob(correct decision|static model)$\equiv \Pi^C$

- ▶ if the agent is rational, dynamic model is better
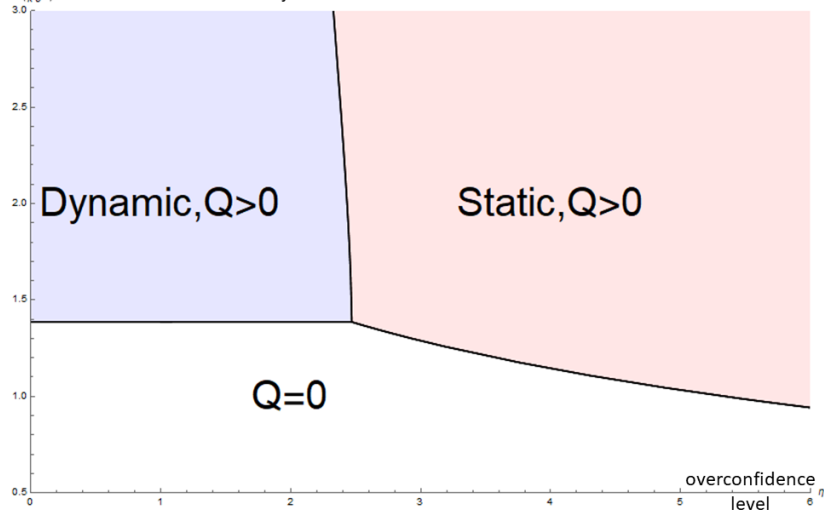- ▶ dynamic model brings force 3 that decreases the probability of the correct decision

Theorem

There is a unique level of overconfidence such that $\Pi^D > \Pi^C$ below that level, and $\Pi^D < \Pi^C$ above it. Moreover, this level is decreasing in the agent's payoff benefit Q from the correct decision
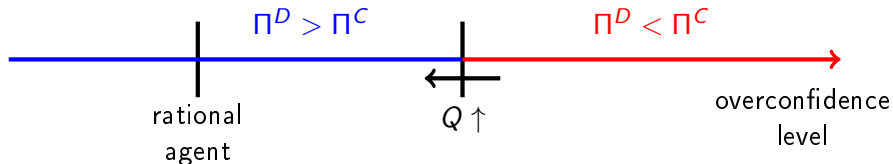
- ▶ $Q \uparrow \Rightarrow$ for rational agent $\Pi^D \uparrow 1$ and $\Pi^C \uparrow 1$

Optimal Contract (Model, Q)

Conclusion

1. Model of overconfidence:
   - level of overconfidence = degree of misperception of information precision
   - ↑ overconfidence ⇒

     force 1 : ↑ precision of the next piece of information ⇒ more information

     force 2 : ↑ precision of already collected information ⇒ less information

     force 3 : ↑ weight placed on noise when updating beliefs ⇒ stop sooner than expected ⇒ less information

2. Policy recommendation: force a highly overconfident decision maker to commit to the amount of information he is going to collect in advance