# UBS Center for Economics in Society

at the University of Zurich



# **Gregory Crawford** Universität Zürich



# Economics of Global Challenges Making better business decisions with (Big) Data

in association with

CEPR

#### Making Better Business Decisions with (Big) Data

#### Gregory S. Crawford

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**UBS** Center Webcast

February 7, 2024

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### Introductions

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February 7, 2024 1 / 33

#### Introductions



What I've learned over my career: Let the data "tell its story"

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#### The (Previous) Data Literacy Keynote Unleash the power of data to make better



#### business decisions

• I'm as excited as she is to see what's around the bend in the road!

#### Let's begin with a short



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# How would the company have made the decision to green-light the idea 15 years ago?



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# How would the company make the decision to greenlight the idea now?



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What's Changed?



"Are you just pissing and moaning, or can you verify what you're saying with data?"

S: The New Yorker (?), circa 2010 🗠

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Data

#### It all starts with Data



Data

More Recent Economist Covers

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S: The Economist, 27 Feb 2010 (HI) ~

#### More Data Demands More Analysis



- "Mankind created 150 exabytes of data in 2005. This year [2010], it will create 1,200."
- "Data are becoming the new raw material of business: an economic input almost on par with capital and labor"

#### • But... Which data? And how to use it???

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# A Hierarchy of Business Problems

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#### A Hierarchy of Business Problems needing Solutions

- What are the problems facing a business?
  - And how might we use data (and/or other tools) to answer those problems?
- I see two main types of business problems:
  - Problems where the future is like the past
  - What if" problems where the future is not like the past

#### Group I: When the future is like the past

- When the future is like the past, it is often appropriate to use forecasting (prediction) methods, e.g.
  - Buying budgets, capacity planning, logistics algorithms, etc.
- In this space, data scientists are pre-eminent
  - Sometimes working in partnership with experts in operations research with large-scale optimization expertise
- For me, data scientists  $\equiv$ 
  - People (usually) with a statistics × computer science background...
    - ★ ...often using machine learning and/or AI tools

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#### Group II: "What if" business problems

- More common is the case where a business wants the answer to a "what if" question, i.e.
  - Questions that typically start "What would happen to revenue/profit/new customer acquisition if we ..."
- For example,
  - "… reach agreement to carry the goods from Brand X?"
  - "… change the features of our loyalty program?"
  - "… change a key customer-facing algorithm?"
    - ★ many many <u>many</u> more...

#### Thousands of business problems to solve... For every business!

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#### "What if" business problems and Economics

- In my experience, the *majority* of business decisions are given by answers to "What If" business questions.
- These are <u>causal</u> questions...
  - ▶ ... and Economics answers causal "What If" questions!

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#### What does success look like?

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February 7, 2024 11 / 33

#### What does success look like?

- A successful answer to a business problem has three key elements:
  - Stimates of <u>the causal effect</u> of a given business "instrument" ...
  - ② … on long-run outcomes…
  - **③** ... that are segmented (e.g. by customer, by product, by market, etc.)
    - \* To allow doing more of what works well and less of what doesn't

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#### How exactly?

- How exactly does economics (best) answer causal "what if" questions?
- With a three-step approach:
  - Experimentation where *feasible* and *efficient*
  - 2 Economics where not:
    - \* Where experimentation is *not feasible*: applied economic theory or econometric causal inference methods
    - ★ Where experimentation is *not efficient*: structural econometric methods informed by experiments
  - **O** *Plus* further economics when the business question demands it, e.g.
    - \* Settings where there may be strategic responses by other players (e.g. suppliers, advertisers, competitors)

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#### What's the "Holy Grail"?

- The aspiration: achieve the "Holy grail":
  - 000s of experiments estimating the ROI of various activities,
  - Insights accumulated and traded off within automated "steering" algorithms
  - Optimized decisions varying by country × customer type × customer intent × partner type × location × time (...)

# Like the difference between "personalized medicine" and "what my doctor thinks will work"

Companies with Experimentation Platforms

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One Last Important Problem: A (Two-level) Skills Gap

# A (Two-level) Skills Gap

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#### Who is Going to Solve These Problems? I

- My talk today isn't only about business problems and the tools to solve them
- It's *also* about

Who is going to solve these problems???

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#### Who is Going to Solve These Problems? II

- There are (I think) two parts to this problem:
  - **1** Who will choose the right tool for the right problem?
  - 2 Given a problem, who will analyze the data to find its answer?
- The second one is a bit easier, so start with that...

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#### Who's Going to Analyze All This Data?



- "A new kind of professional has emerged, the data scientist, who combines the skills of
  - A software programmer,
  - Statistician, and
  - Storyteller/artist

to extract the nuggets of gold hidden under mountains of data."

- Hal Varian, Google Chief Economist:
  - "Data ... are widely available; what is scarce is the ability to extract wisdom from them."

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#### Who's Going to Analyze All This Data? (2011 version)



- "A new kind of professional has emerged, the data scientist econometrician, who combines the skills of
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#### Who's Going to Analyze All This Data? (2011 version)



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#### Who's Going to Analyze All This Data? (2024 version)



- "A new kind of professional has Two new kinds of professionals have emerged, the data scientist *and* the econometrician, who combine the skills of
  - A software programmer,
  - Statistician, and
  - Storyteller/artist Interpreter

to extract the nuggets of gold hidden under mountains of data."

- Hal Varian, Google Chief Economist:
  - "Data ... are widely available; what is scarce is the ability to extract wisdom from them."
- Two types makes sense: data scientists specialize in prediction problems; econometricians specialize in causal inference problems

#### • But...

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#### There is an *additional* problem



Run the business

Make the business run

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#### Can they talk to each other? If not, why not???

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#### An additional problem, cont.

• Business leaders who wish to use data for business decision-making

and

- Applied scientists tasked with analyzing that data
  - ... often struggle to communicate effectively

Why?

- Business leaders often lack technical skill
- Applied (data) scientists often lack business experience
  - $\blacktriangleright$   $\rightarrow$  The former have trouble knowing what's been done/what's possible
  - $\blacktriangleright$   $\rightarrow$  The latter have trouble knowing what's needed
    - ★ (Particularly when there are tradeoffs to be made)

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#### An additional problem, cont.

- What is needed?
  - ► In my view: systems engineers or "conductors" or "interpreters"
- People with skills in:
  - Business
  - Applied economic theory
    - ★ Esp. re: competition/strategy
  - Econometrics
    - ★ Esp. re: causal effects estimation
  - Data science
    - ★ For prediction/forecasting
  - Engineering
    - $\star$  To understand the basics of data pipelines/data products

#### ... and not least ...

Communication!

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#### The Right Tool for the Right Problem? (2024 version)



- "In my experience, [MBAs] who have a good business intuition but also can speak the language of statisticians intelligently are <u>rock stars</u>...
  - They know how to use data to prove a point,
  - Present the information well visually, and
  - Pull together a collection of empirical facts that all support the main conclusion.
- "People with this set of talents are poached by other firms and quickly promoted. They are the go-to people on any sort of major strategic project."
  - Susan Athey, Professor of Economics, Stanford GSB, former Microsoft Chief Economist

My (2nd) thesis: *(Some) <u>economists</u> also have this skillset* (Esp. <u>empirical</u> economists, a.k.a. econometricians) (Especially *competition* econometricians) (Case in point: Amazon)

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How many PhD economists work in detailed business operations for Amazon? [approx. 1k graduates w/PhD and 20k w/MBA in U.S. per year]



32%

32%

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#### Other Big Tech firms are beginning to follow suit

#### Why economists are flocking to Silicon Valley

And why big tech wants them



The Economis

#### But Why Economists / Econometricians?

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February 7, 2024 25 / 33

Why might economists with data skills (i.e. econometricians) be well-suited to pick the right tool for the right problem?

Econometrics is *incredibly useful* 

② Econometrics is increasingly useful

Seconometrics can be used to do good

• Econometrics is *incredibly useful* 

- Econometrics is increasingly useful
- **③** Econometrics can be used to *do good*

• Econometrics is *incredibly useful* 

- ② Econometrics is increasingly useful
- Seconometrics can be used to do good

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- (Good) Econometrics is *incredibly useful*
- (Good) Econometrics is *increasingly useful*
- (Good) Econometrics can be used to *do good*

(But only if it's good econometrics)

#### What is Good Econometrics?

Good Econometrics encompasses three "pillars":

- An understanding of the economic forces generating the data,
- The specification of an econometric model and estimation approach that can accurately and flexibly measure those forces, and
- **O** A careful interpretation of the results

#### Why good *competition* econometricians?

• It turns out good "competition econometricians" have the right skillset:

- Core training in applying competition economics to business problems
- Core training in causal effects estimation
- Familiarity with basic forecasting/data science methods
- Comfort with data cleaning, programming, and optimization
- Comfort making tradeoffs between scientific rigor and the demands of business problems
- My strongly held belief: This Is The Future !!!
  - ▶ (So prepare for it!)
- A Separate Question: How to produce such skills at scale?
  - ► [I have ideas :-)]

### Conclusions

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February 7, 2024 31 / 33

#### Conclusions I

- I firmly believe that a new era is coming for Making Better Business Decisions with (Big) Data
- Last 15 years  $\rightarrow$  today: apply existing tools to new data, e.g.
  - Hire engineers, product managers, and data scientists
  - Pair them with normal business leaders and business analysts
- From today: develop new tools/capabilities for new data, e.g.
  - Build an experimentation platform
  - Hire/train "interpreters" that can effectively connect business leaders to applied (data) scientists (as well as engineers and product managers)

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#### Conclusions II

#### Are these capabilities necessary???

- I believe that the returns to these processes are enormous
  - Those companies that are at the frontier implementing them are among the best performing in the world
    - ★ (Microsoft, Amazon, Netflix)
- Companies that lag behind will be at a significant competitive disadvantage
  - Thus for both offense and defence,
    - \* Worth thinking now how to begin to build these capabilities!

#### Thank you!

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February 7, 2024 33 / 33

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# bnomics. Ir Society.

# Watch **replay** on **YouTube**

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#### More Recent Economist Covers



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(Big Data) Companies with Experimentation Platforms



(What do they do with them???)

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#### How are Experimentation Platforms Used? I

# Uber

- Product and feature development I:
  - Every change to a mobile app is rolled out as an A/B test
    - ★ (Is also reversible)
    - \* (Is also behind a "feature flag", a software control that turns it on/off)
    - ★ (Including bug fixes!)
  - Key business metrics are always closely monitored, e.g.
    - ★ Signup completion, trip taking rate, payments success rate
  - Why?
    - ★ Even a 0.1% decline in trips would cost \$10s of millions!

#### How are Experimentation Platforms Used? II

- Product and feature development II:
  - Netflix's Experimentation Platform is among the best in the world
    - \* "At Netflix, every decision is backed by an experiment"
    - ★ "It helps when the CEO is a former mathemetician." 😂
  - Questions they've addressed using it include:
    - What's the right balance between a large display area for a single title versus showing more titles?
    - Q Are videos better than static images?
    - O How do they select which titles to show?
    - **(3)** Where do the navigation menus belong and what should they contain?

NETFLIX

#### How are Experimentation Platforms Used? III

# Linked in

#### Service Strain Strai

- LinkedIn's experimentation platform operates at very large scale:
  - ★ Involved in 500 production services (!)
  - \* Runs about 35,000 (!!!) concurrent A/B tests daily

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#### How are Experimentation Platforms Used? IV

#### Ompetitive analysis

- Public examples in this area are *much* harder to come by
  - $\star$  Tho it's easy to imagine what one could do
- Imagine a travel intermediary who hosts a large number of travel service providers on its platform
  - \* And wants to know the incremental value to its business of one of its big partners
- ► It could run an experiment testing when the big provider was *excluded* from search results
  - \* Not only would this reveal impacts on its customers' conversion rates, transaction value, etc.
  - \* But also to which other partners customers would switch when the big partner wasn't available

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#### How are Experimentation Platforms Used? V

- In my opinion, the number of business decisions able to be informed by an experimentation platform is almost endless!
  - Tho that doesn't mean that every business decision can be!

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#### How are Experimentation Platforms built?

• Maybe more important: How are they built?



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