Economics of CyberSecurity

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About This Talk

- Why this talk? Why economics?
- **Intro econ concepts**
- Topics from the edX MOOC
- **CyberSec applications - "Cyber"**

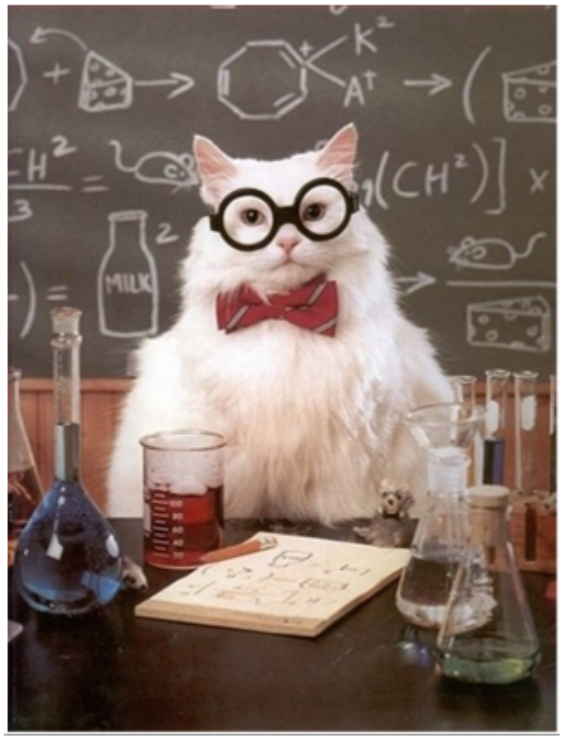
- Slides will be up at http://www.slideshare.net/fsmontenegro

About me

@fsmontenegro

- Sales Engineer
  - Network Security
- CompSci ’94
- Greying hair

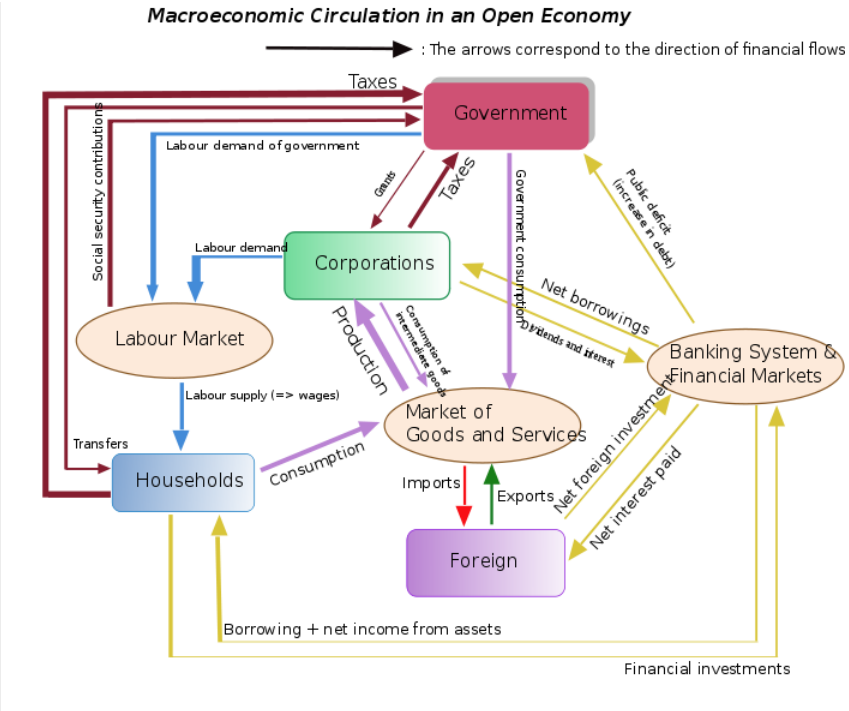
- Curious
  - Finance (DIY)
  - Economics (EMH, Behaviour)
  - Data Science (Coursera)



KEY ECON CONCEPTS

Macroeconomics

- National Economies
- Fiscal & Monetary Policy
  - Monetary Supply
  - Interest Rates
- Inflation
- Unemployment
  - Frictional
  - Cyclical
  - Structural

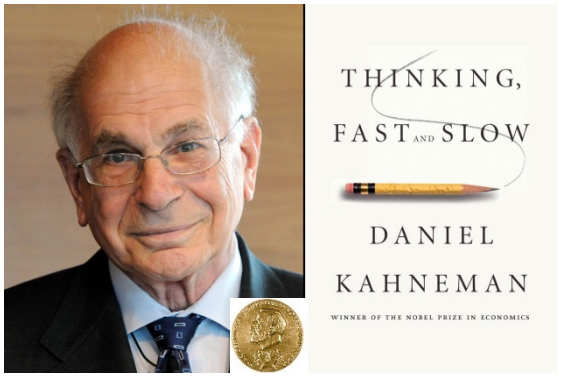


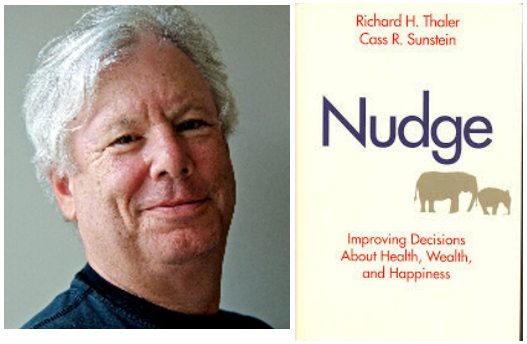
Microeconomics

- Allocation of Scarce Resources
- Individuals & Markets
  - Market Mechanisms
  - Types of Goods
- Supply and Demand
- Maximize Utility
- Information Economics
- Decision & Game Theory

(Behavioural Economics)

- *"Bounded rationality of economic agents"*
  - Humans vs Econs
- Daniel Kahneman, Amos Tversky
- Richard Thaler, Cass Sustein
- Popular - Dan Ariely, Steven Levitt
- Cognitive Biases
  - Availability
  - Confirmation
  - Intertemporal Choice
    - Hyperbolic Discounting
  - ...
- Incentives!





“Markets”

- [Perfect] Market Models
  - Goods, Labour, …, even Money itself
  - Price is signal
- Market Efficiency
  - Everyone is “better off”

What does a Market Need?

- Large # of buyers and sellers
- Complete property rights
- Perfect information
- Rational actors
- No/low transactions costs
- Non-increasing returns to scale
- …

Market Failures

of Buyers & Sellers

- Monopoly / Monopsony
  - Inefficient
  - Barriers to entry
  - Price Discrimination
  - Monopoly captures consumer surplus

Property Rights

- Externalities
  - Negative
    - Free Riding
    - Too much production
    - Moral Hazard
  - Positive
    - Not enough production

Market Failures

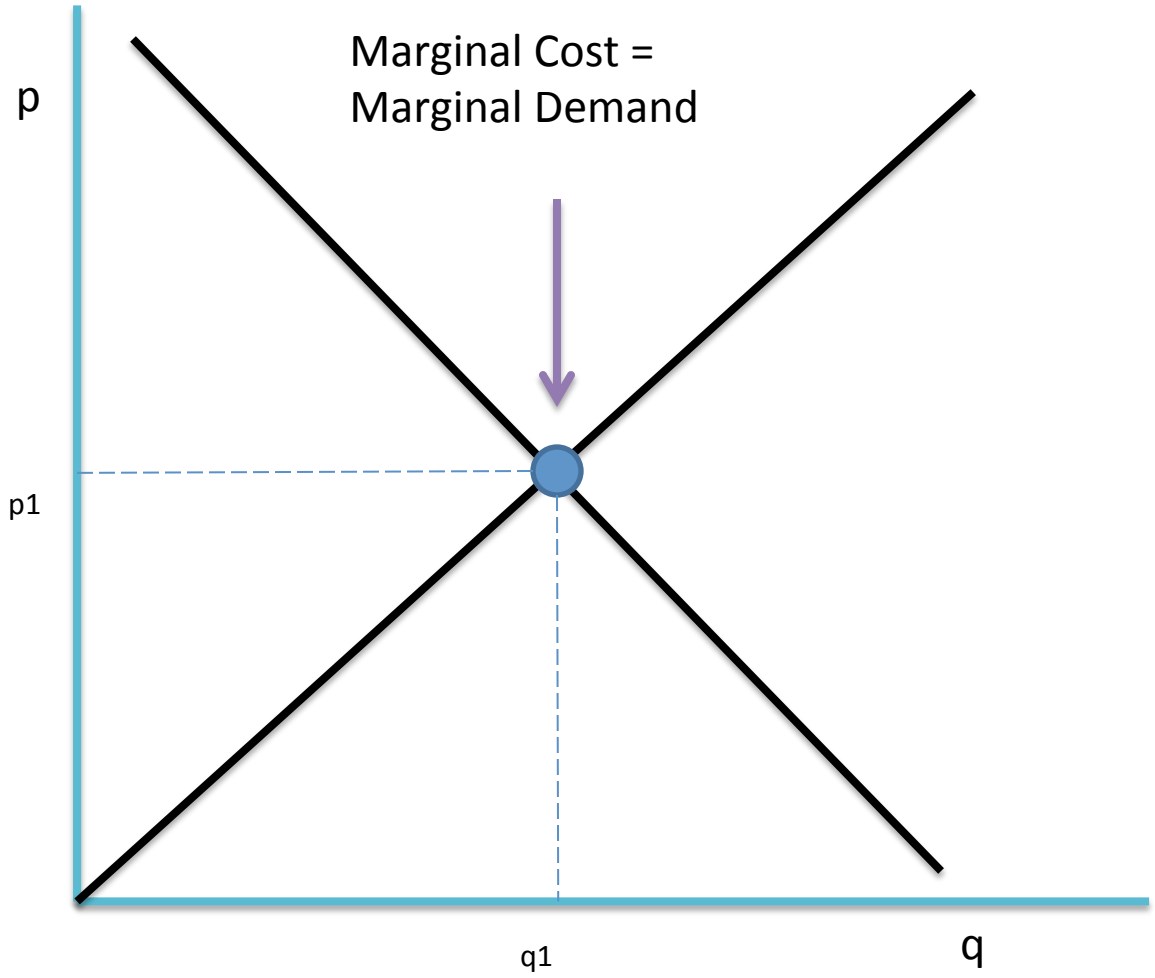
Lack of Information

- **Information Asymmetry**
- Adverse Selection
- Principal-Agent Problem

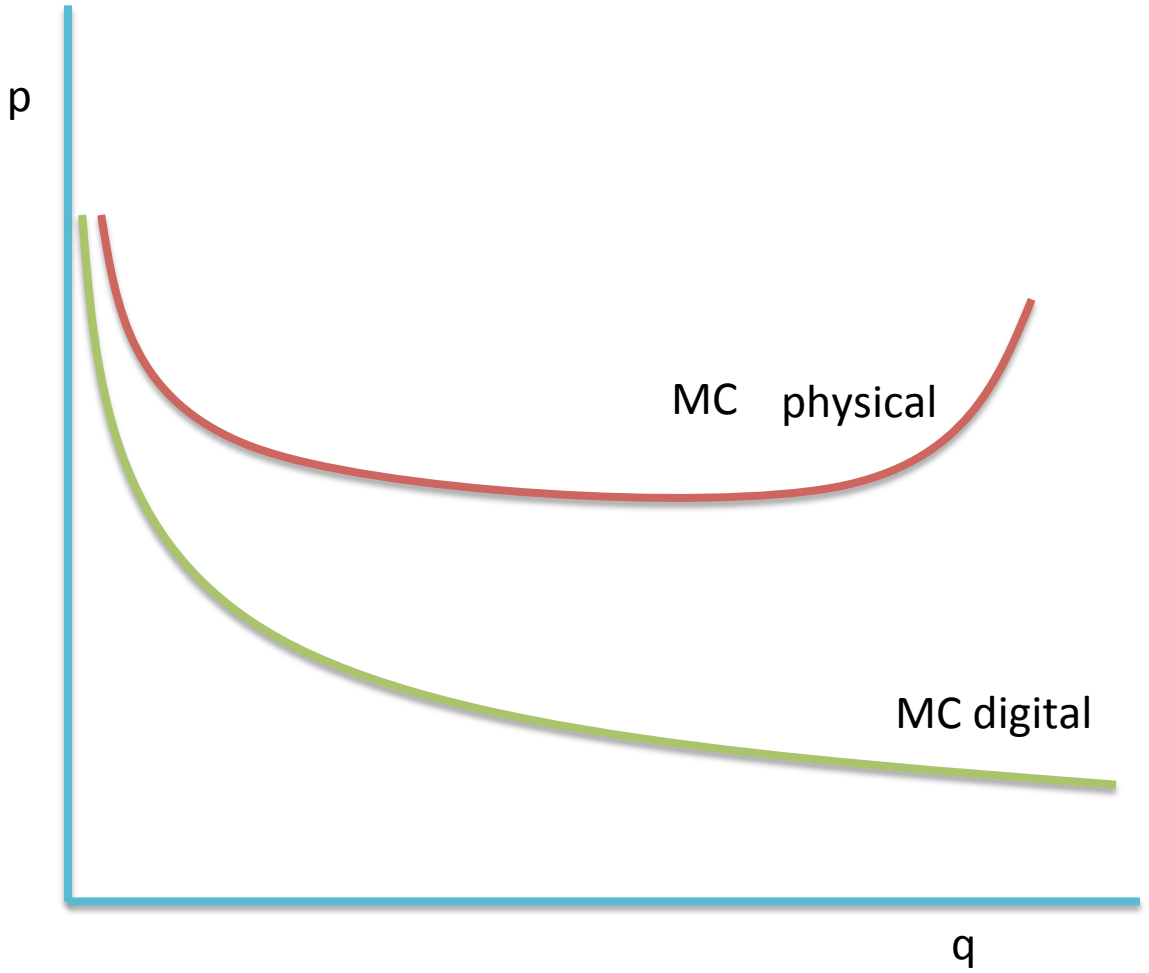
Others

- Irrational actors
  - Biases
- High transaction costs
  - Lower production
  - Lower agility
  - Regulatory Capture

101 - Demand, Supply & Price



Marginal Cost



Information Goods

- HIGH fixed costs, low marginal cost
- Prone to monopolies
- Market race
  - 1st mover advantage
    - **TIME-TO-MARKET!**
    - **MINIMUM VIABLE PRODUCT**
  - Appeal to Complementary Goods
  - Network effects! (Metcalfe's Law: n^2)
  - …

Information Asymmetry

- Akerlof's "Market for Lemons"
- Adverse Selection

- Signalling & Screening

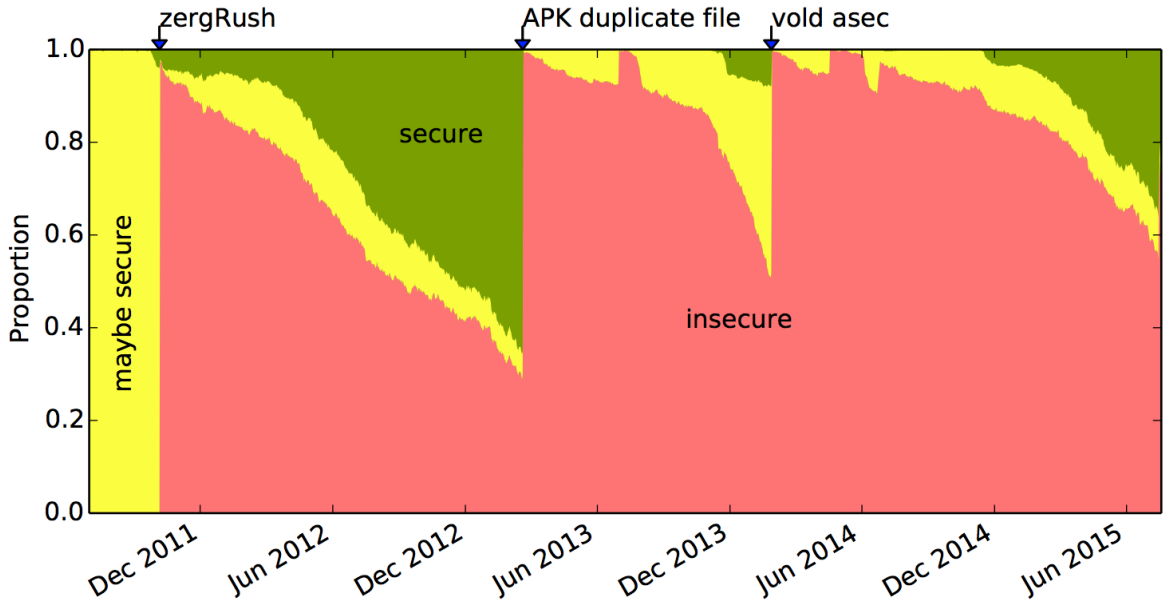
ECONOMICS IN CYBERSECURITY

Software Development & Systems Design, Operations

- Information Asymmetry
  - **Is the product secure? We can't tell!**
    - Anderson, 2001
- Market Failure - Externalities
  - Onus of patching falls on customer
  - Free riding in open source
- Misaligned Incentives
  - Allocation of Liability
  - Opportunity Cost of Patching

Externalities at play...

- 87.7% Android exposed to at least 1 vuln
  - Thomas, Beresford, Rice 2015



Privacy

- Stated preferences vs actual preferences
- Bias: Hyperbolic Discounting
  - Present benefit undervaluing future privacy
- Extraction of 'willingness to pay'
  - Monopolies
  - Price discrimination

Risk Management

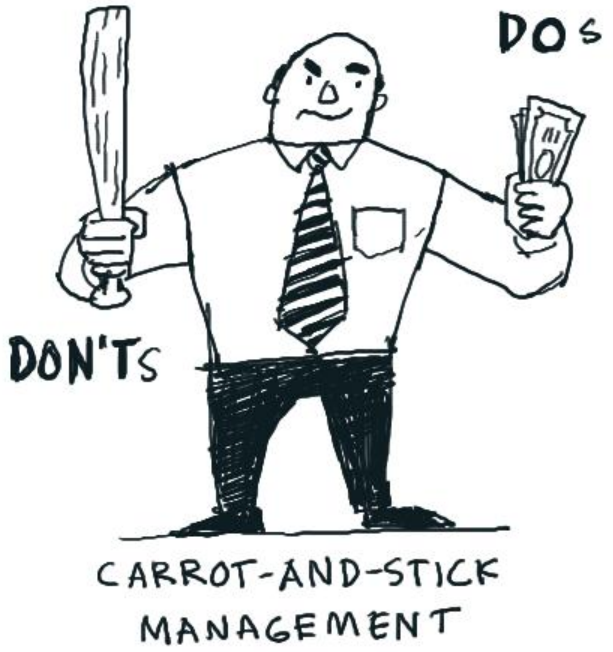
- Security investments – Gordon-Loeb model
- Qualitative vs Quantitative Risk Management
- Information Asymmetry
  - Principal-Agent Problems
- Risk transfer (insurance)
  - Adverse Selection -> Higher Premiums
  - Correlated risks

Cybercrime & Anti-Fraud

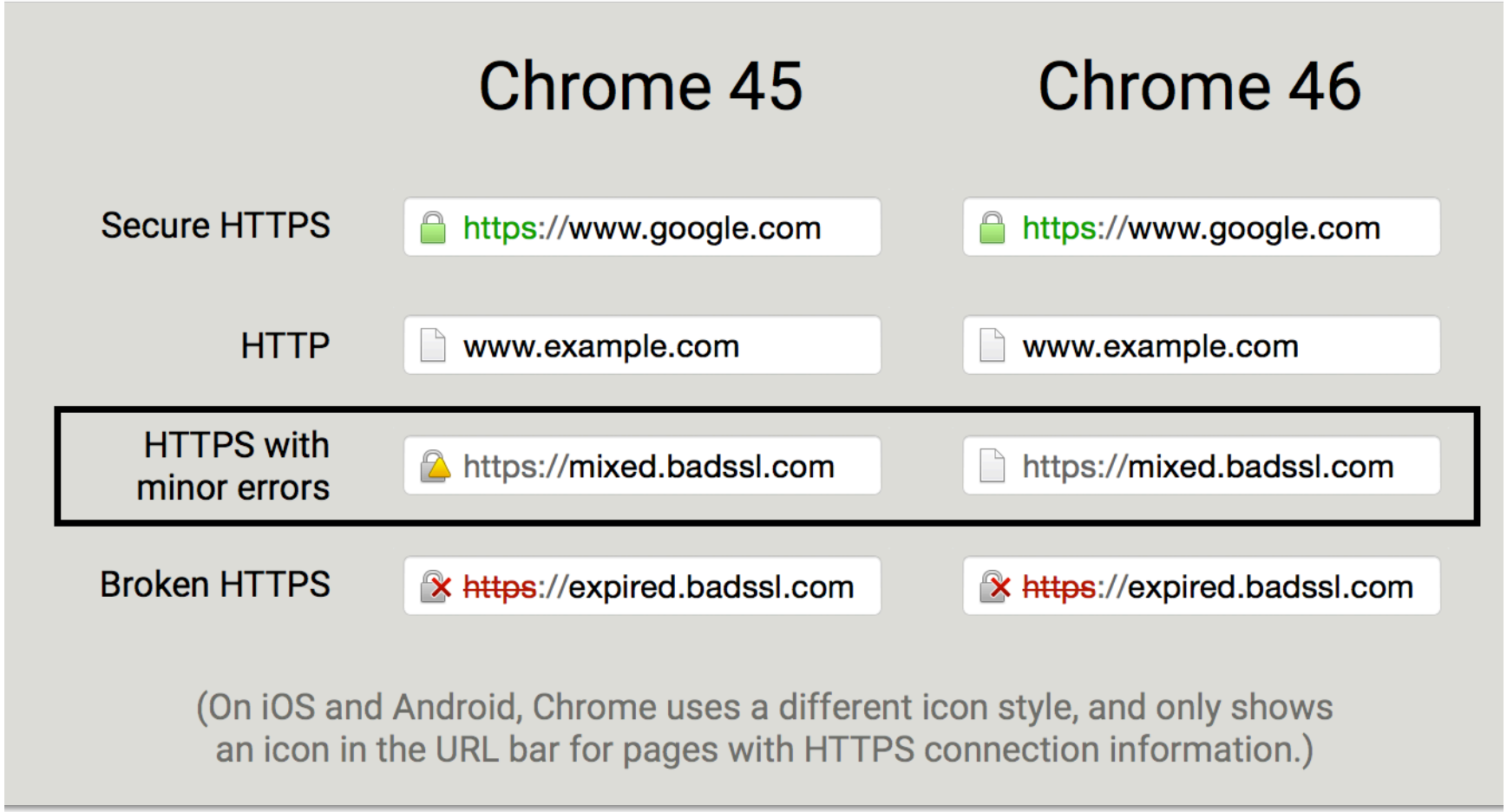
- Liability & Incentives
  - Fraud liability and 3DS/EMV liability shifts
- Underground Markets
  - Dynamic, evolving ecosystems (Red Queen)
  - Possible bottlenecks in cash-outs and mules
- Other Externalities Exist…
- Perverse Incentives for LE?
  - High volume, low scale crime not aggregated

Security Awareness

- Behaviour Economics – defaults, nudges
- Incentives drive behaviour!
- Moral Hazard
- Principal-Agent Problem
  - Management
  - Individuals



Behavioural Econ in action



Security Labour Market

- 0% Unemployment?
  - Incentive to automate/reduce headcount
- Information Asymmetry
  - Signaling – Credentials, Certifications
  - Screening – Interviews, Job Options
- Perverse Incentives also exist

WRAPPING UP

Recap

- Key concepts
  - Markets & Market Failures
  - Information Asymmetry
  - “Incentives, incentives, incentives!”
- Key areas
  - End-user Behaviour (Corporate and Consumer)
  - Risk Management
  - Software Development Practices

Call to Action

- Consumer
  - Understand markets, tradeoffs, incentives
- Citizen
  - Understand incentives at play in government
- Professional
  - Focus on the right levers (incentives...)
  - Be mindful: isn't "security" itself an externality?

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Slides at

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