

# Economics of Cyber-Trust

Jonathan CAVE  
RAND Europe and University of Warwick  
United Kingdom

Support of DTI-foresight and EC IPTS gratefully acknowledged; all errors remain my own.

26 October 2005 Digital Identity Forum Copyright 2005: Jonathan Cave

WARWICK



## Identity as property

Who steals my purse steals trash; 'tis  
something, nothing; t'was mine, 'tis his, and  
has been slaves to thousands;

But he that filches from me my good name  
robs  
me of that which not enriches him, and  
makes  
me poor indeed

Othello, III,iii,157-61(Iago)

26 October 2005 Digital Identity Forum Copyright 2005: Jonathan Cave

WARWICK



## Economics and identity

- Economic analysis considers incentive and selection effects
- Sheds light on the structure and performance of institutions via stakeholder conduct
- Both the technologies and the way they are used (demand and supply) are endogenous
- Identity is used in societal interactions, so interoperability and trust are important
- Virtual identity is shared identity
  - Local in time, place and purpose
  - Changed via use

26 October 2005 Digital Identity Forum Copyright 2005: Jonathan Cave

WARWICK



## Identity and Trust: friends or foes?

- Information Society (IS) institutions provide the warp and identity and trust provide the weft of the social fabric
- Trust involves uncertainty; identity can substitute for the unknown:
  - I know who you are, if not what you are or will do
  - I will tell you who I am as a token of good faith
- Trust and anti-trust
  - The role of identity and trust in markets
  - Markets for identity and trust services
  - Shared identity - co evolution of trust, social networks
- Impacts and implications for policy and research

26 October 2005 Digital Identity Forum Copyright 2005: Jonathan Cave

WARWICK



## Identity and Trust

- Identification can be
  - Based on what you have, know, do...
  - Tied to physical being, legal power, resources...
  - Multiple (divergent) or single (convergent)
  - Owned or shared
- If I trust you, I:
  - Believe or act on information you provide
  - Let you act on my behalf
  - Rely on you not to abuse the information or power I provide
  - [trust those who you trust]

## Trust: an action “in expectation”

| Who (what) trusts whom? |               | Trusted Party   |                            |                       |
|-------------------------|---------------|-----------------|----------------------------|-----------------------|
|                         |               | People          | Systems                    | Organisations         |
| Trusting party          | People        | Societal trust  | Agency, privacy, accuracy  | Reputation, Assurance |
|                         | Systems       | Fault-tolerance | Complex system reliability | N/A                   |
|                         | Organisations | Agency          | Reliance                   | Firm networking       |

### The importance of matching trust and trustworthiness

|            | Trustworthy   | Untrustworthy  |
|------------|---|--|
| Trusting   | Appropriate delegation, specialisation                    | Enforcement costs, costs of adverse incidents        |
| Untrusting | Excess contracting, monitoring costs; race-to-the-bottom. | Lost gains from trade, inappropriate risk allocation |

## Trust: an institution

- Trust is an incomplete contract...
- Assurance is a substitute or even an enemy of trust
  - Monitoring, enforcement replace (undermine) trust
  - Penalties vs. indemnification
  - Applies to default contracts (tort, criminal law)
- Trust in identity and reputation
  - Identity is trust as a local public good
  - Reputations can be milked
- Ethical conventions
  - Character and the self-enforcing uses of identity

## Impacts of Information Technologies

- Increased “reach” and “bandwidth” or interactions
- Weakens some institutions
  - Anonymity undermines reputations
  - Globalisation reduces common framework
  - Intellectual Property Rights
- Strengthens others
  - Digital signatures, PKI, biometrics
  - Repudiation and risk of mistakes
- Increased use of non-human agents we must trust to:
  - Act for us
  - Inform our actions
  - Not abuse information for other purposes.
- Which are we – our bodies, our avatars, or our records?

## Trust structures

- Trusting and trustworthiness make and break links
- Generically, stable outcomes have “too much” or “too little” interconnection
- Example: costly links + “myopia”

| Costs  | Efficient       | Equilibrium     |
|--------|-----------------|-----------------|
| High   | No trust        | No trust        |
| Medium | Star-shaped     | No trust        |
| Low    | Universal trust | Universal trust |

- Rings, small worlds and inequality

26 October 2005

Digital Identity Forum

Copyright 2005: Jonathan Cave

WARWICK

RAND

EUROPE

## Trust as a convention

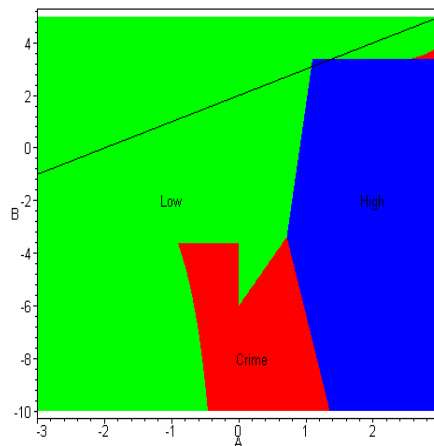
People play against neighbours

Periodically, they can try to change

Diagram: unique long-run stable outcome in fully-connected network

Other structures have e.g. diversity

|       | High  | Low  | Crime |
|-------|-------|------|-------|
| High  | 5, 5  | A, B | -4, 3 |
| Low   | B, A  | 3, 3 | 0, 0  |
| Crime | 3, -4 | 0, 0 | 1, 1  |



26 October 2005

Digital Identity Forum

Copyright 2005: Jonathan Cave

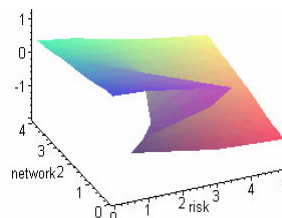
WARWICK

RAND

EUROPE

## Trust dynamics

- Choose high- or low-trust channel based on 2 factors:
  - Expected risk
  - ‘Network benefit’ (increasing with % of high-trust people)
  - Factor weighting not observed
  - Learn from experience: trusting individuals put high weight on risk
- Figure: equilibrium trust
- Note path dependence
- If people learn from media, trusting ones are a sample of population
- Table shows different response to fall in risk



|                          | Experience      | Media    |
|--------------------------|-----------------|----------|
| No network externalities | Fall            | Constant |
| Peer-to-peer             | Rise, then fall | Rise     |

## Trust and antitrust

- Horizontal:
  - trust-enhancing ‘tacit collusion’
  - Easier to hide cheating in global, personalised markets
  - Search engines increase scrutiny and restore collusion
- Vertical:
  - Reduced cost of differentiation/ market sharing
  - Personalisation raises search costs
  - Enhanced power of search, payment intermediaries
  - Tipping and standardisation
- Network:
  - Complements and lock-in
  - Lowered internal security barriers
  - Adoption follows catastrophe curve
- The same features apply to interoperability
  - Excess volatility and excess inertia
  - Worsened by information, reaction lags and conflicting standards

## Market policy

- Antitrust:
  - Value of reputation, effective market control
  - Interoperability groups with 'soft centres'
  - Ownership of knowledge: private (IPR) or public (standards) goods
  - Persistence of early leads
- Consumer protection:
  - How to signal quality and reinforce search
  - Equivalent protection vs. country of origin
- Liability:
  - Balances efficiency and fairness
  - 'Commons' effects like Spam, viruses

26 October 2005

Digital Identity Forum

Copyright 2005: Jonathan Cave

WARWICK



EUROPE

## Do identity technologies usefully enhance trust?

- Biometrics offers 'strong identification'
  - But it has weaknesses as well
    - False positives
    - False negatives
    - Precise solution to the wrong problem
    - The system may fail even when the technology succeeds
    - Cost incidence determines what we get
- Identity may be too strong (ex – voting, cash transactions)
  - More identity vs. more identities
- More trust does not imply efficient risk allocation

26 October 2005

Digital Identity Forum

Copyright 2005: Jonathan Cave

WARWICK



EUROPE

## Launching customers

- Major public procurements are the drivers of much current progress:
  - Known difficulties with large-scale, high-tech procurement
  - Difficulty of buying ‘things that don’t yet exist’
  - High-profile experiences shape perceptions of users, financiers
  - If successful, large installed base and market share for specific technologies may:
    - Provide a 'ladder' path to restart private sector use
    - ... or damage competition, lock in inefficient technologies.
- Specific compatibility and market dominance issues relating to international procurements (e.g. US VISIT)
- There is a particular danger when technological capabilities (and thus the *use of the system*) are not known before tendering – *privatising identity policy*

## The Road Ahead...

- No doubt that biometric identity will become increasingly important and increasingly integrated
- Systems integrators will be major players
- One vision is convergent: a single or broad-use identity platform, with institutional safeguards and a narrow (mix of) technologies and wide exchange of data
- The polar possibility is fragmentation into ‘small worlds’ – possibly with differing technologies offering appropriate mixes of costs and error types

26 October 2005

Digital Identity Forum

Copyright 2005: Jonathan Cave

WARWICK



## Brief coda

- Trust can reinforce Information Society winner-takes-all tendencies
- Competition to provide assurance can compensate for free-riding and fraud
- Lock-in attempts can produce too much trust
- More is not better, and evolution trumps control
- Sustainability may rest on *asymmetry*
- *Identity theft may become rarer and more serious*
- *Opting out may become hard and exclusion easy*

26 October 2005

Digital Identity Forum

Copyright 2005: Jonathan Cave

WARWICK

