Innovation in non-bank payment systems

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Payment system innovations

• Non-networked but micro-chipped
  – Stored value cards (telephone, Starbucks, transit)
• Networked
  – Older proprietary networks:
    • Credit cards
    • Debit cards
    • Bank wire transfers
  – Web-based:
    • Internet (web) payment using credit cards
    • Micro-payment aggregation on the web (e.g., iTunes)
    • Bank transfers; electronic bill paying
    • Non-bank bill pay services
  – And mobile telephones

All these innovations use microprocessors or the internet
=> General Purpose Technologies
Themes

• supply and demand for innovation
• networks and standards – effects on diffusion
• general purpose technologies and co-inventions
• A few facts (but difficult to define the sector accurately)
  – Who are the players
  – Who are the patenters? (inventors?)
Determinants of innovation

• Supply
  – Cost
  – Market size and expected demand
  – Expected cost reduction
  – Market structure (radical vs incremental)
  – Appropriability (Alappat, State Street)

• Demand
  – Perceived benefits
  – Reliability and security
  – Sunk costs of learning (network effects)
Networks and standards

• Many innovations based on IT exhibit network characteristics
  – Value to individual user depends on the number (and sometimes identity) of other users => larger networks preferred
  – Full benefits occur when there are a variety of ways to connect to the network => benefits from standard interfaces; gateway technologies
  – Increasing returns to scale => tend toward quasi-monopoly

• Theory: networks supplied either monopolistically or competitively tend to be too small
Payment networks

• Internet – model open network
  – There is only one
  – Open standards
  – Relatively rapid diffusion for payment methods
  – But need for security; some proprietary methods - not ideal from consumer point of view

• Proprietary standards networks:
  – Stored value cards?
    • limits diffusion and value to consumer
  – Mobile telephones
    • Much lower cost for consumer (no computer or internet connection)
    • Alternative to stored value cards?
GPTs

• A technology that is useful in a broad range of industries and for a variety of purposes. Characterized by
  – Pervasiveness
  – Inherent potential for technical improvements
  – Innovational complementarities
  – Importance of technical standards for interoperability

• Historical examples:
  – Steam engine
  – Electricity
Microprocessor

• A GPT that has been essential to
  – Personal computing revolution
  – Internet
  – Wireless communication

• Different from earlier examples
  – More complex set of innovations
  – Much steeper cost declines over longer periods
As memory size increases, price falls: over 30 years, by $10^8$ per bit
Relative Prices of Computers and Semiconductors, 1959-2003

All price indexes are divided by the output price index.
Consequences of GPTs

• Many co-inventions needed (and become possible), e.g. non-bank payment systems, digital security, etc.
• Skill requirements increase at first; can lead to temporary increases in wage inequality
• Diffusion may be slow
  – encouraged by open standards or those sponsored by a large player or industry consortium
• Achieving full benefits slow (increasing returns)
• As industry matures, often tends to vertical disintegrate (spinoffs, specialization and outsourcing)
Who are the players?

• Bradford, Davies, and Weiner (2006) lists main players:
  – 10 alliances
  – 45 firms, in 22 industries:
    • Most important: data processing & hosting; financial transaction processing – about 14% of all firms in these sectors
  – 20 entered after 1993

• Look at the two NAICS codes with the largest share of these firms
  – High median revenue growth for 20 years, now falling
  – Growth in number of firms, flat since 2001
Median annual revenue growth - Data processing, hosting, and financial transaction processing
Patenting

• Rapid growth following court decisions in 1994/95 and 1998

• 60% of BDW firms hold patents in technologies related to payment systems
  – However, almost all patents in these technologies are held by other firms (IBM, large Japanese, etc.)
  – BDW firms hold only about 2-3% of the patents (figure)
Patents granted in 94 class/subclass combinations used by NPS firms

- **Payment systems firms only**
- **All**