

Computers and Economics

Week 12b - April 12

Week 13a – April 17

Discussion: D-Link's Misuse of NTP provider in Denmark

- Poul-Henning Kamp operated a pro bono service for NTP in Denmark
free
 - Was meant for large servers, not clients, only in Denmark
 - ISP waived the \$4,400 connection fee
- D-Link hardwired (firmware) his server as the NTP server: GPS.dix.dk
 - Led to enormous traffic flows, from d-link products
 - Cost him time and money to figure out the problem, and ISP wants money to handle the traffic
- What happened? Why? Is this an inherent risk in the Internet?
 - Aside: if you have a popular home movie, and millions of people want to see it, what happens?
- More info at: <http://people.freebsd.org/~phk/dlink/>

Economics Discussion

- Where is the money in the Internet?
 - Which layer?
 - Which segment of the topology/geography?
 - Is this sustainable?

Who has the Money?

INNOVATOR	EPS (\$)	MKT CAP (\$B)
MCIW	-11.22	6.5
SPRINT/NXTL	-0.31	34
VERIO/NTT	1.98	71.6
LEVEL3	-0.74	1.9
SBC/T	1.41	78
QWEST	-0.45	7.7
COGENT	-7.42	0.2
GLBC	-13.84	0.3
SAVVIS	-0.90	0.12
ABOVENET	n/a	n/a
WILTEL	n/a	n/a
TELEGLOBE	-0.74	0.2
C&W	0.70	4.7B
TWTELCOM	-1.12	1.0
(TWARNER)	0.48	82
XO	-2.18	0.4

INNOVATOR	EPS (\$)	MKT CAP (\$B)
CISCO	0.87	108
GOOGLE	3.41	97
AMAZON	1.25	19
YAHOO	1.07	49
EBAY	0.73	51
JUNIPER	0.53	13
APPLE	1.56	47.
INTEL	1.33	141
VERISIGN	0.93	6.15
DELL	1.27	76.3
MICROSOFT	1.12	269B

source: finance.yahoo.com, 25 oct 2005

Verizon



Still has a \$95B market capitalization...but stalling
(This is post bubble...)

Net Neutrality

■ Very big issue in the Internet world

- Should the government regulate?
- Do they have the mandate?
 - Not yet, but there are laws on the books

■ Telcos

- Want to bit-discriminate to help them compete with cable
 - Claim: improve TV competition
- Ed Whittacre, Chairman of AT&T (formerly SBC)
 - “Now what they would like to do is use my pipes free, but I ain't going to let them do that. . . The Internet can't be free...because we and the cable companies have made an investment and for a Google or Yahoo or Vonage or anybody to expect to use these pipes free is nuts!”

What is a Software (or Hardware) Company?

- Standard Industrial Classification (SIC) codes classify companies
 - By the Securities and Exchange Commission (SEC)
 - 3570 Computer & office Equipment
 - 3571 Electronic Computers
 - 3572 Computer Storage Devices
 - 3575 Computer Terminals
 - 3576 Computer Communications Equipment
 - 3577 Computer Peripheral Equipment, NEC
 - 3578 Calculating & Accounting Machines (No Electronic Computers)
 - BUT, 35 includes other machinery

(NEC=Not Elsewhere Classified)

SIC Examples (cont.)

- 3652 Phonograph Records, Prerecorded Audio Tapes & Disks
- 3661 Telephone & Telegraph Apparatus
- 3663 Radio & TV Broadcasting & Communications Equipment
- 3669 Communications Equipment, NEC
- 3670 Electronic Components & Accessories
- 3672 Printed Circuit Boards
- 3674 Semiconductors & Related Devices
- 4812 Radiotelephone Communications
- 4813 Telephone Communications (No Radiotelephone)
- 4822 Telegraph & Other Message Communications
- 4832 Radio Broadcasting Stations
- 4833 Television Broadcasting Stations
- 4841 Cable & Other Pay Television Services
- 4899 Communications Services, NEC
- 5731 Retail-Radio, Tv & Consumer Electronics Stores
- 5734 Retail-Computer & Computer Software Stores
- 5735 Retail-Record & Prerecorded Tape Stores
- 7385 Services-Telephone Interconnect Systems

SIC Examples (Cont.)

■ But what about...

- When a company does many things?
 - IBM – 91.3 B\$ of sales
 - How much is software (#2 rank, after Microsoft)?
 - **Primary SIC Code**
 - 7379: Computer related services, NECs
- Embedded use (entities that heavily use ICT)?
 - Consulting, or even Fedex
 - Walmart has possibly the best ICT in the world, after US Dept. of Defence
 - Early adopters of RFIDs

Economics and Analysis

- Macroeconomics
- Microeconomics
- Development Economics
- Financial Economics
- Behavioral Economics
- *Etc.*

Microeconomics

- Where does it apply?
 - Individual, selfish actors
 - What are its fundamentals?
 - Markets, competition, information
 - What are its components?
 - Supply, Demand, Price (latter signals behavior)
 - What are its limits and shortcomings?
 - Assumes efficient markets, no externalities, market-clearing prices, etc.
- A firm (or individual, *rational* actor) usually deals with microeconomics

Macroeconomics

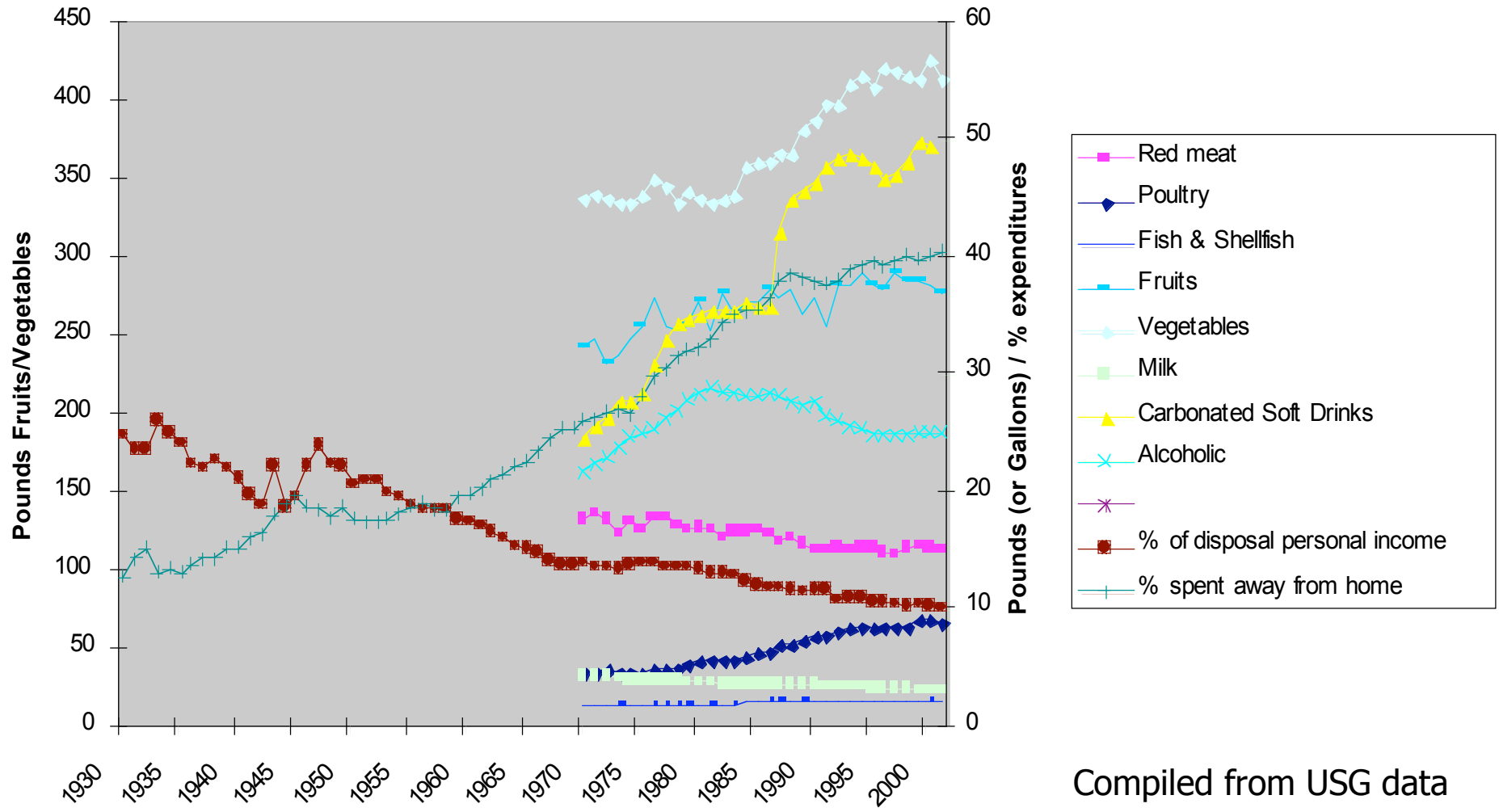
- Study of the overall economy, including overall production, supply, prices, employment, etc.
 - Includes currency, taxes, monetary policy, etc.
 - Domain including policy interventions
- *(Beyond the scope of this course to discuss these issues)*
- Global linkages
 - Trade
 - Tariffs
 - Exchange rates

Economics is about tradeoffs - Think about *Food*

- Diets in the US have changed – for the worse
- But we're spending less money for the food
- In other countries, *calories* might be available but not nutrients

- *Are we rational?*
 - Why don't we back up our data more?

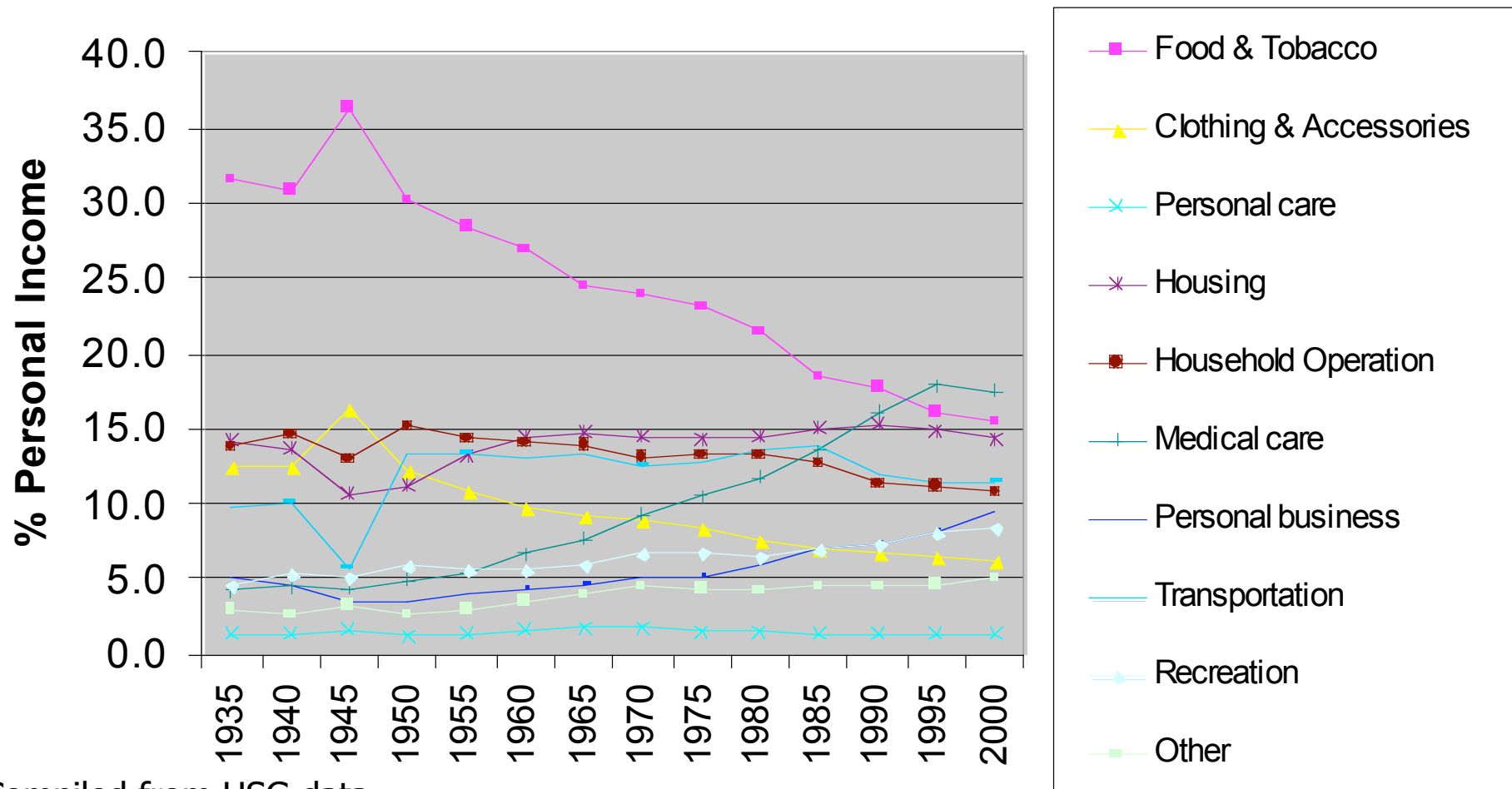
US Food Changes



Compiled from USG data

US personal expenditures

Computing is often embedded inside these categories



Compiled from USG data

Data Challenges

- Classifications are often fuzzy
 - Very difficult to disaggregate
- Measurement challenges
 - It takes time to see results
 - What is an investment versus operating expense?
 - Buying a computer?
 - Training to use a computer?
- Accounting tricks
 - E.g., swaps of revenues (ala Enron)
- Why is such data limited in value for many developing countries?
 - Non-monetary expenditures
 - Wide variance between very poor and super rich

Broadband

Some other issues

- Information asymmetry and inaccuracy
- Non-monetary transactions
 - Informal economy (a.k.a. black market)
- Models apply only at the margin (e.g., elasticity)
 - Under equilibrium conditions
 - Mean vs. median issues
- What am I spending money on?
 - Goods versus services (different accounting)
 - What is hardware vs. software
- Time spent on different activities
 - Non-monetized
 - Rebooting a PC, crashed hard drives

Analyzing Costs - “TechnoEconomics”

- Often thought in terms of
 - Capital Expenditures (Capex)
 - Operating Expenditures (Opex)
- Must know all costs over time (lifecycle – more on that later)
- Need to deal with NET cash flows
- Capital costs need to be converted into an annual (or monthly/quarterly) equivalent \equiv amortization

Amortization

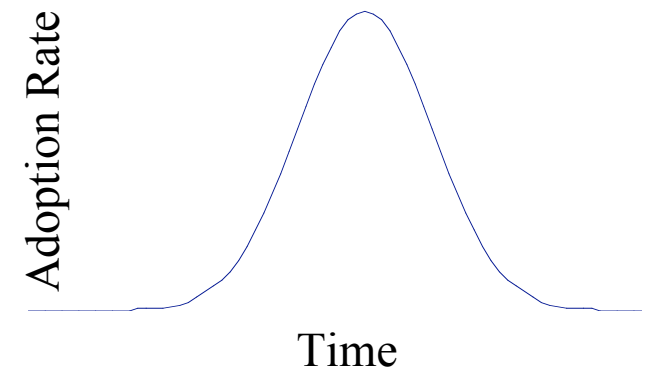
- Long term capital costs need to be paid back
 - Principal
 - Interest
 - (Think of a mortgage)
- Two things that matter
 - Timeline for repayment
 - Interest (aka discount) rate
- What's a fair discount rate?
 - Depends on the *risk*
 - Rule of thumb might be to use ~10% (in the US)
- Actual amortization is based on a formula (see Excel "PMT")

Offshoring

- Debate focuses on employment
 - Comparative advantage is best explained under full employment
 - New jobs vs. displacing old jobs
- Blue-collar vs. white-collar jobs
 - Manufacturing shifted in the 1980s and 1990s
 - China, Mexico
 - What about migrant labor and immigration?
- How is (or isn't) this different from outsourcing?
- Value chain is an important concept – different tasks are worth relatively more (or less)
- What portions of ICT are moving offshore?
 - Call centers
 - BPO
 - Design (?)

Technology and Productivity

- Role within economy
 - Increasing share of services (~2/3)
- Adoption of new technologies
 - Bell Curve
- Schumpeterian destruction?
 - Disruptive technologies
- Solow found a residual to economic growth
 - Could only be explained by technology
- New business models and market structures
 - Where is the market power?
 - Fundamental Technologies
 - New market creation
 - Implementation
 - *Issues of barriers to entry, commoditization, etc.*



Integral = "S-shaped"
Saturation
OR
Obsolescence

Comparing Technologies

■ Car – 1930 vs today

- Miles per gallon?
 - 25 MPG is which year?
- Mid 1920s – Model T
 - \$290
 - Equivalent to ~1/3 of per capita GDP
- What has changed?
 - The baseline keeps moving!

■ PC from 1985 vs. 2005

- \$4,000 buys you what?

Productivity

- Growth in productivity spurs economic growth
- Often, easiest to measure based on labor inputs to given output
- Other inputs (multi-factor productivity)
 - Capital
 - Energy (resources)
- US productivity is not much higher than that of France
 - On a PER HOUR basis
- [Discussion] What are tradeoffs that occur in using an ATM vs. a teller?

Cost Benefit Analysis

- All metrics must be in a comparable form (usually \$)
 - Implicitly/explicitly need to value time and perhaps even human life!
- Whose costs are factored?
 - Company, end-users, and third parties?
 - Increasing reliance on user (distributed) effort = self serve
- Pareto Optimality
 - Economic condition where no one can be made better off without someone become worse off == TRADEOFFS
- Must include time value of money
- Must include all *net* costs, across the lifecycle
 - Always a lot of uncertainty, especially regarding future impacts

CBA: Hypothetical Case--Small Business Setting up Web Presence

- Why would they do so?
 - Profitable?
 - Stylish?
 - Mandatory?
- Getting the economics right depends on assumptions
 - Cash flow impact
 - Amortization
 - Lifespan (payback)
 - Discount rate (~interest rate)
 - Risk tolerance
- Other challenges for economics overall
 - Baselines (what existed before then changes)
 - Network effects (and externalities)

Presenting Your Work...

Creating Figures and Graphs

- Should be (relatively) self-explanatory
- Many readers will be drawn to these
 - Instead of reading the whole paper (more important for non-poster papers)
- Graphs are often preferable
 - Esp. when precision (significant figures) aren't as important

General Tips

- Significant figures – be realistic
- Show units
- Use footnotes only as needed (simplify, simplify, simplify), but DO use them as required
 - Sources are esp. important if copied from a source

Tips for Tables

- Align columns properly
- Consider shading alternating rows to help align readers, esp. in print (e.g., IEEE styles)
- Keep font large enough to be readable (esp. for posters)

Tips for Figures

- Label your axes
- Don't use 3-D charts for 2-D axes
- Match significant figures
- There are other graphs than the ones Excel offers (visualization tools)...e.g., GIS-based, thermal visualizations (“hot spots”), etc.

