Online Promiscuity

Prophylactic Patching and the Spread of Computer Transmitted Infections

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Research Questions

• How can exploratory epidemiological models help us better quantify online risk?
  – How can we use exploratory epidemiological models to help us better understand the risks due to online risk takers?
Motivation and Related Work


*Notes.* Profit and welfare curves are illustrated for low effective security risk ($\pi_d\alpha = 0.20$) and high effective security risk ($\pi_d\alpha = 5$) under both nonrestrictive ($\rho = l$) and restrictive ($\rho = n/l$) security patch policies. The remaining parameters are $c_p = 0.20$, $\pi_d c_\sigma = 0.05$, and $\nu = 0.65$. 
Figure 1: Purchase/Update Decision when Marginal Consumer Type $\theta^*(p) < \hat{\theta}$

Model Creation and Methodology
Methodology

• Variation of single parameter in single population group
• Variation of single parameter in both population groups
• Full Uncertainty and Sensitivity Analysis
• Model Fitting
Results

Small groups of risk takers represent a threat to the risk adverse population.
Effective contact rates and recovery rates govern whether or not a pandemic occurs.
Cost of maintaining risk adverse behavior and recovery due to social response are critical components throughout the lifetime of infection. Ability to apply security measures in response to threats is effective in initial stages, but not long term.
Model Fitting

- Top ten spoofed entities account for ~83% of observed attacks.
- Top 20 entities account for ~95% of observed attacks.
- System can be roughly approximated by looking at the top ranked spoofed entity.
Discussion

• We can look at public health costs due to reduction of coverage

• Effectiveness of Risk Communication
Conclusions

• A small risk-taking population poses a risk to the risk adverse population
• Ability to recover to a risk adverse population either through social response or individual behavior is effective at reducing global prevalence of malware through the lifetime of infection
• Ability to apply security measures in response to threats is effective in initial stages, but not long term.
• Reducing the effectiveness in users ability to recover to the risk adverse population increases system wide costs.
Real World Results

Basic Reproduction Numbers of Infection From Observed Data with Monitored Population Varied

- Reproduction number in Argentina (~1.28)
- Reproduction number in China (~1.55)
- Reproduction number of Influenza (~2.0)
Questions and Comments

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