

The Value Of Secure Communication

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April 8, 2016

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Introduction

What is the value of secure communication?

Do people care about the security of their communication and are they willing to pay for it?

How to find out

- ▶ survey the society
- ▶ model the willingness to pay
- ▶ evaluate the influencing variables

Introduction

Underlying data

- ▶ Poll realized in 3 languages, send mostly to students
- ▶ $n = 169$ individuals
- ▶ 18 different variables to evaluate

Tools

- ▶ Use of a google form for the poll
- ▶ Econometrics I and II by Steve Lawford
- ▶ EViews Software

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Survey

Basic Information

- ▶ Gender
- ▶ Year of birth
- ▶ Income

Services

- ▶ Operating System
- ▶ Messaging Services

Provider Change

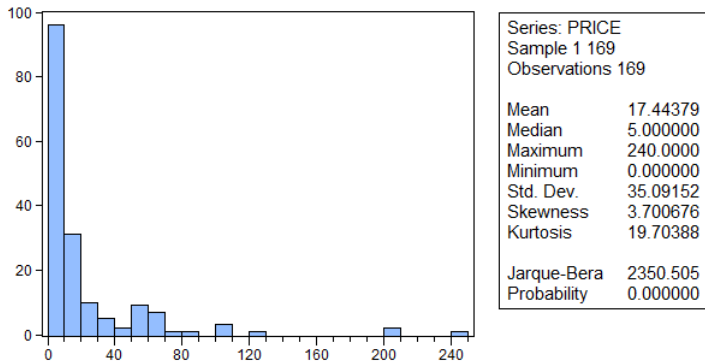
- ▶ Change Reasons

Survey - Security

Ratio questions:

- ▶ How concerned are you about a possible 3rd-party that could access your private conversations?
- ▶ How concerned are you that this is actually happening in your everyday conversations?
- ▶ How often do you NOT send a message or picture due to privacy concerns regarding a 3rd party?
- ▶ How important are transparency and security when you choose your messaging provider?
- ▶ How important is secure messaging to the people in your surroundings? (family + friends)

Survey - Price



We introduced

$$PRICE_{dummy} = PRICE + 10^{-6}$$

to handle the zero-answers

Variables and their effects

Variable	Expectation	1. Model	Significant
Age	-	-	No
Female	-	↓	No
Nationality : German	-	↑	No
Nationality : French	-	↓	Yes
Nationality : British	-	↓	No
Educational : High School	↑	↑	No
Educational : University	↑	↑	No
Income : <20	↓	↑	No
Income : 20< . <25	↑	↓	Yes
Income : 25< . <30	↑	↓	No
Income : 30< . <40	↑	↓	No
Profession : Employee	↑	↑	No
Profession : Management	↑	↑	No
Profession : Student	↓	↑	No
Profession : Unemployed	↓	↓	No

Variables and their effects

Variable	Expectation	1. Model	Significant
OS : Android	-	↓	Yes
OS : IOS	-	↓	Yes
OS : Windows	-	↓	Yes
Threat	↑	↑	No
Transparency	↑	↑	No
Access	↑	↓	No
Environment	↑	↑	No
Concerns	↑	↑	No
Security : All	↑	↑	No
Security : None	↑	↑	Yes
Awareness : High	↑	↓	No
Awareness : Low	↓	↑	Yes
Change : 0	-	↓	No
Change : 1	-	↑	No
Change : 2	-	↓	No
Messaging Service	-	?	No

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Mathematical Model

$$\begin{aligned} PRICE &= C \prod_{i=1}^k \beta_i^{x_i} \\ \Leftrightarrow \ln PRICE &= \ln C + \sum_{i=1}^k x_i \ln \beta_i \\ &= \bar{C} + \sum_{i=1}^k x_i \bar{\beta}_i \end{aligned}$$

⇒ Linear model

First Model Equation

Model Equation :

Dependent Variable: LOG_PRICE_DUMMY

Method: Least Squares

Date: 04/07/16 Time: 14:37

Sample: 1 169

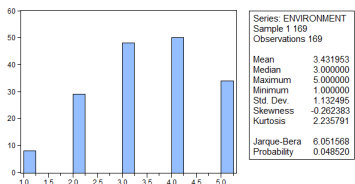
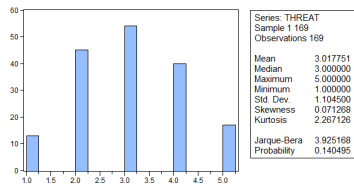
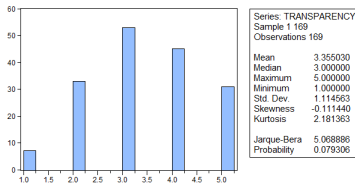
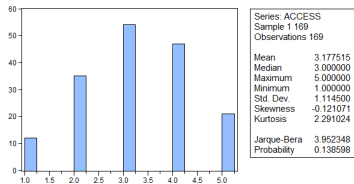
Included observations: 168

	Coefficient	Std. Error	t-Statistic	Prob.
C	-23.50979	186.7948	-0.125859	0.9000
BIRTH	0.006416	0.095205	0.067393	0.9464
GENDER	-1.185077	1.604497	-0.738597	0.4615
IS_GERMAN	3.897808	2.940005	1.325783	0.1873
IS_FRENCH	-4.897586	2.606048	-1.879315	0.0625
IS_BRITISH	-1.775856	3.382157	-0.525066	0.6004
EDUC_HIGHSCHOOL	3.895542	5.189952	0.750593	0.4543
EDUC_UNIVERSITY	4.817589	5.154802	0.934583	0.3517
INCOME_LE20	0.358182	2.684709	0.133416	0.8941
INCOME_20TO25	-5.637476	2.794529	-2.017326	0.0457
INCOME_25TO30	-0.896535	2.922057	-0.306816	0.7595
INCOME_30TO40	-4.505486	3.206966	-1.404906	0.1625
PROF_EMPLOYEE	3.030871	3.500660	0.865800	0.3882
PROF_MANAGEMENT	1.331497	5.298852	0.251280	0.8020
PROF_STUDENT	2.135578	4.289151	0.497902	0.6194
PROF_UNEMPLOYED	-1.043527	5.329789	-0.195791	0.8451
OS_ANDROID	-6.160803	3.672939	-1.677350	0.0959
OS_IOS	-6.529232	3.794600	-1.720664	0.0877
OS_WINDOWS	-9.509864	4.371611	-2.175368	0.0314

THREAT	0.847923	0.923231	0.918429	0.3601
TRANSPARENCY	1.162933	0.835051	1.392650	0.1661
ACCESS	-0.762045	0.944909	-0.806475	0.4215
ENVIRONMENT	0.052007	0.748412	0.069490	0.9447
CONCERNS	0.747319	0.725990	1.029379	0.3052
SEC_ALL	1.061868	2.235646	0.474971	0.6356
SEC_NONE	3.146895	1.543674	2.038575	0.0435
PRISM_HIGH	-1.333882	1.925836	-0.692625	0.4898
PRISM_NO	3.344405	1.696014	1.971920	0.0508
CHANGE_0	-1.186181	1.465794	-0.809241	0.4199
CHANGE_1	0.673116	1.778214	0.378535	0.7057
CHANGE_2	-0.832459	1.797701	-0.463069	0.6441
HAS_FACEBOOK	-0.293571	1.893134	-0.155071	0.8770
HAS_WHATSAPP	2.604731	1.718143	1.516015	0.1320
HAS_TELEGRAM	6.641844	5.143466	1.291317	0.1989
HAS_THREEMA	-5.239325	4.813326	-1.088504	0.2784
HAS_SKYPE	1.484876	1.439530	1.031500	0.3042
HAS_SNAPCHAT	0.8277781	1.768938	0.467953	0.6406
HAS_SLACK	-6.398633	4.164920	-1.536316	0.1269
HAS_NOthing	1.925887	3.391403	0.567873	0.5711

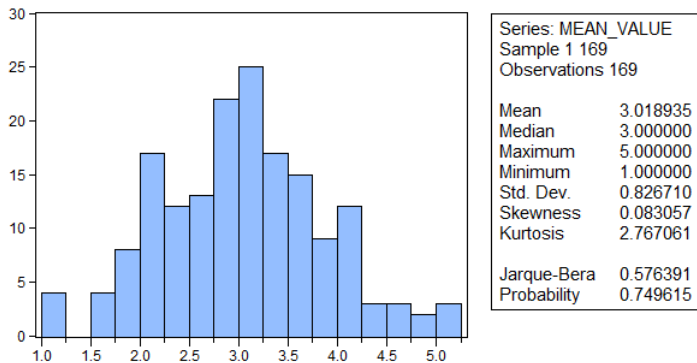
R-squared	0.327090	Mean dependent var	-4.492097
Adjusted R-squared	0.128868	S.D. dependent var	8.253334
S.E. of regression	7.703203	Akaike info criterion	7.121284
Sum squared resid	7654.775	Schwarz criterion	7.846490
Log likelihood	-559.1878	Hannan-Quinn crit.	7.415608
F-statistic	1.650122	Durbin-Watson stat	2.005604
Prob(F-statistic)	0.020567		

Problem Analysis (1)



Problem Analysis (2)

The resulting variable:



Problem Analysis (3)

- ▶ It seems to be not relevant, which message-service you use - makes sense!
- ▶ The change reason - is unimportant for the price, rather whether one is willing to change

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The same model as before:

$$\ln PRICE = \bar{C} + \sum_{x_i \in \Omega} x_i \bar{\beta}_i$$

But now only with a subset of the variables:

$$\Omega = \{NATIONALITY_{french}, INCOME_{20to25}, INCOME_{25to30}, \\ SECURITY_{none}, PRISM_{NEVER}, MEAN\}$$

Result

Dependent Variable: LOG_PRICE_DUMMY

Method: Least Squares

Date: 04/07/16 Time: 19:06

Sample: 1 169

Included observations: 169

	Coefficient	Std. Error	t-Statistic	Prob.
C	-8.008486	2.342171	-3.419257	0.0008
IS_FRENCH	-5.013098	1.358596	-3.689912	0.0003
INCOME_20TO25	-6.160444	1.866446	-3.300628	0.0012
INCOME_30TO40	-4.619805	2.379219	-1.941731	0.0539
SEC_NONE	2.239133	1.199886	1.866122	0.0638
PRISM_NO	2.859497	1.405689	2.034232	0.0436
MEAN_VALUE	1.816870	0.720168	2.522842	0.0126
R-squared	0.190494	Mean dependent var	-4.437188	
Adjusted R-squared	0.160512	S.D. dependent var	8.259636	
S.E. of regression	7.567774	Akaike info criterion	6.926213	
Sum squared resid	9277.936	Schwarz criterion	7.055854	
Log likelihood	-578.2650	Hannan-Quinn criter.	6.978824	
F-statistic	6.353663	Durbin-Watson stat	1.986591	
Prob(F-statistic)	0.000005			

Test for homoscedasticity

Heteroskedasticity Test: White

F-statistic	0.970988	Prob. F(21,147)	0.5023
Obs*R-squared	20.58678	Prob. Chi-Square(21)	0.4844
Scaled explained SS	8.395020	Prob. Chi-Square(21)	0.9932

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.781574	Prob. F(6,162)	0.5855
Obs*R-squared	4.754447	Prob. Chi-Square(6)	0.5757
Scaled explained SS	1.938801	Prob. Chi-Square(6)	0.9252

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Conclusion

- ▶ The price seems to depend on the the users impression of threat-levels
- ▶ also the nationality seems to play a minor role - or maybe just an artifact

What could be better

- ▶ Make income an open question
- ▶ Make more diverse ratio questions - maybe increase possible range
- ▶ more answers to increase precision
- ▶ not representative in many variables (birth, profession, ...)



Thank you for your attention.

Any questions?