Dynamic Effect of Supplementary Product Rating

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1. INTRODUCTION

Several substantive questions arise on the effect of product reviews on demand for a supplementary product: How supplementary product rating affects its demand? How product rating of different supplementary products affects their demand? Whether share of platform affects persistency of product rating effect? Whether developer team size, observed by consumer, affects consumers evaluation of the supplementary product? How does uncertainty on product rating in the context of experience good affects consumers valuation of user base size signal?

2. LITRATURE

3. MODEL DEVELOPMENT

3.1. Aggregate Demand and Goodwill Stock

Given our interest in assessing the effect of product rating on demand, we excercise aggregated sales response model. The model is constructed on the discrete time analog of Nerlove and Arrow's (1962) model. Specifically, Nerlove and Arrow suggest the use of "goodwill stock," to capture persistent effect of advertising on demand. To demonstratet this more clearly in the supplementary product context, we assumed that product rating build the goodwill stock (G) of the supplementary product. In turn, this goodwill drives the demand for the supplementary product, oprationalized as the daily download divided by 1k (y_{it}). That is,

$$y_{it} = G_{it} + \beta_i * Z_{it} + \epsilon_{it}, \text{ where } \epsilon_{it} \sim N(0, V_i) \ (1)$$
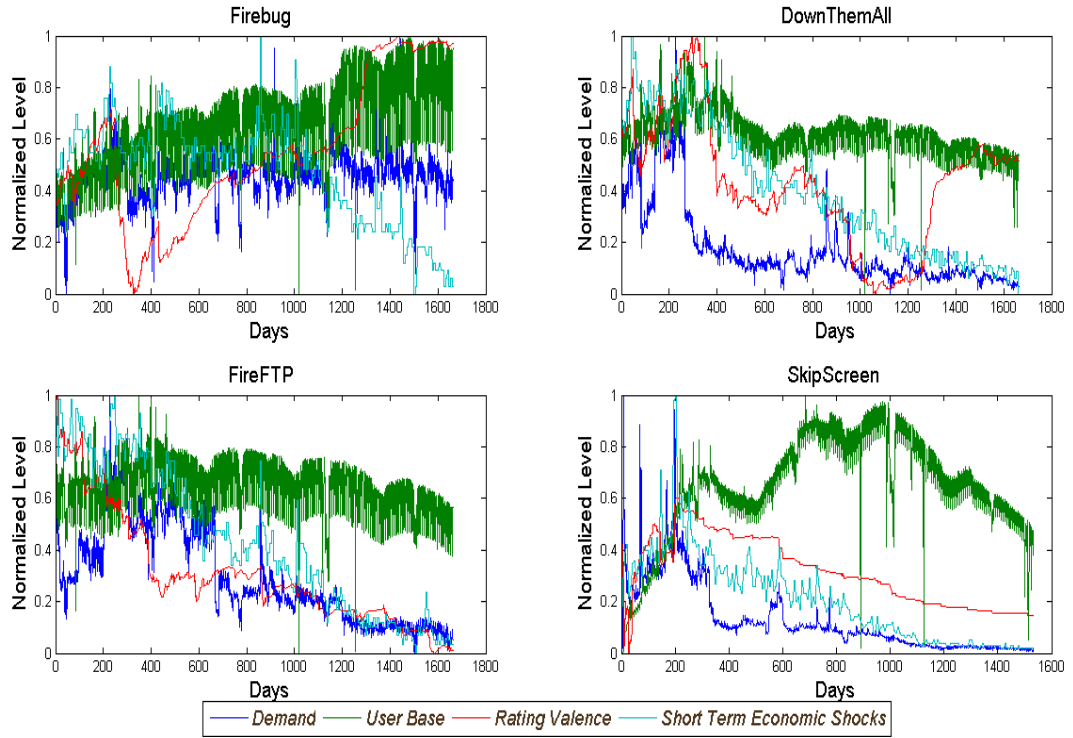
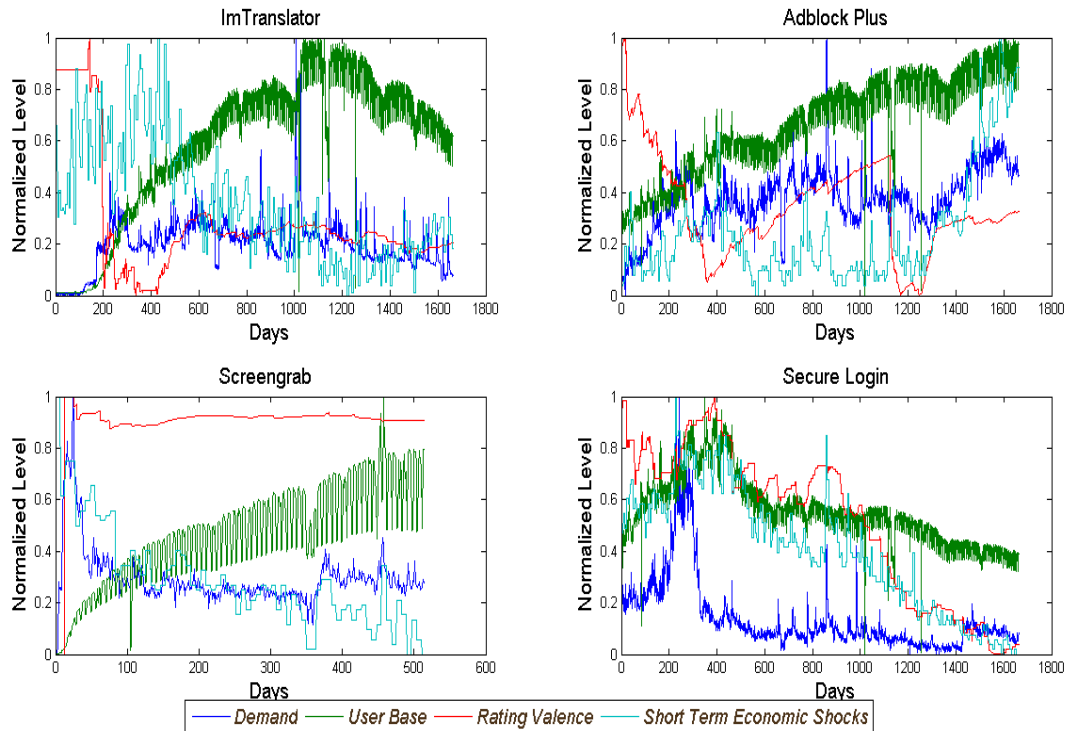**Figure 1   Examples of Demand, Rating Valence, Usage and Short term Economic Shock (Normalized)**

Figure 2   Examples of Demand, Rating Valence, Usage and Short term Economic Shock (Normalized) Cont.

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	Mean	SD	Min	Max
Share of Windows	0.86	0.15	0.03	1
Number of Reviews	382.64	584.93	2	3686
Variance of Rating	1.46	0.76	0.48	4.2
Size of Developer Team	1.32	0.72	1	4

Table 1   Basic Statistics

The vector Z_{it} comprises control variable of weekend dummy.

Consistent with Nerlove and Arrow's specification, supplementary product's goodwill (G) decays in proportion to the lagged goodwill, while it is maintained by consumers rating, user base, short term economic shock, and versioning, represented by X_{it}, as follows:

$$G_{it} = \delta_i G_{it-1} + \gamma_i * X_{it} + \omega_{it}, \text{ where } \omega_{it} \sim N(0, W_i) \quad (2)$$

3.2.   Heterogeneity

The effect of product rating, user base, short term economic shock and carryover may differ across products, as for example, need category and competition in the market of the supplementary good may be different. Thus, we also acknowledge such potential hetrogeneity by linking carryover rate, and effect of rating, user based, short term economic shock and versioning from Equation 1 and 2 to a set of supplementary product characteristics, such as platform share, and size of developer team.

$$\{\delta_i, \gamma_i\} = \Psi U_i + \xi_i, \text{ where } \xi_i \sim N(0, M) \quad (3)$$

4.   EMPIRICAL STUDY
4.1.   Data

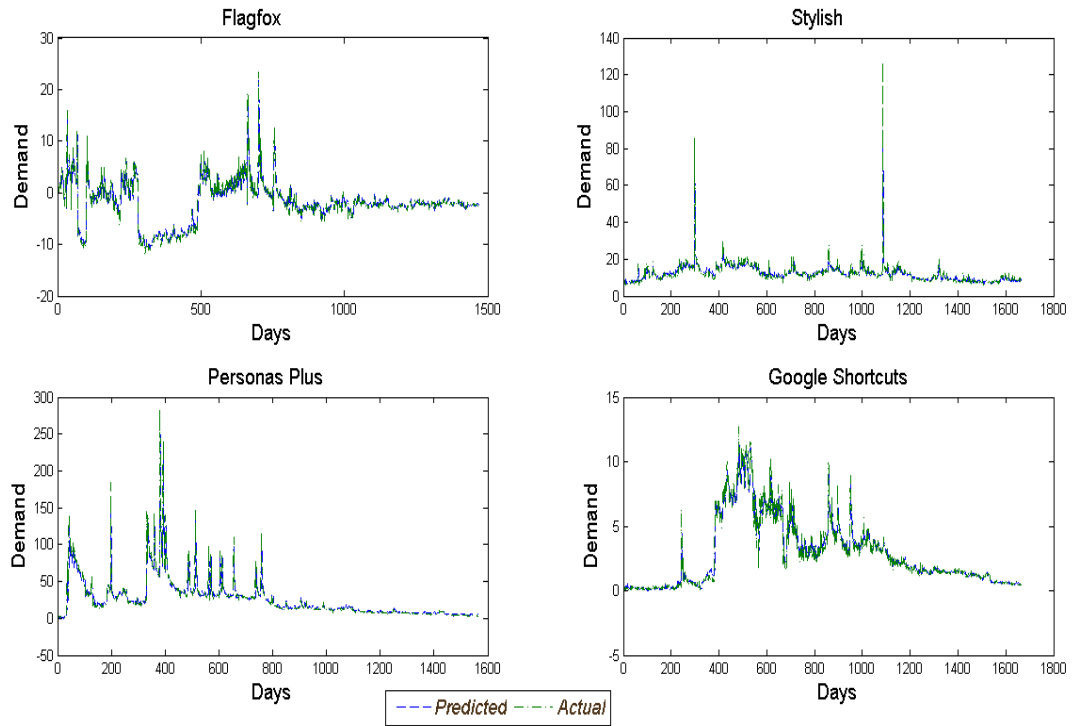Our data are from 50 Add ons of firefox and span around five year period (1686 days) from 2008 to 2013.
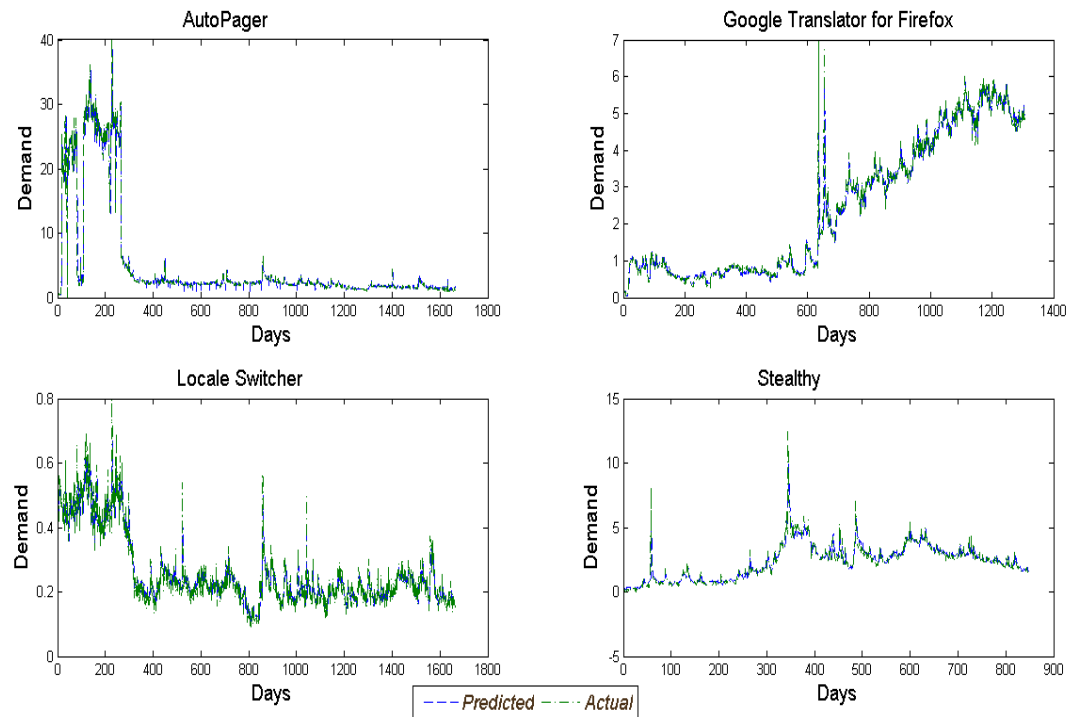
Figure 3   Examples of Predicted Versus Actual Demand

Figure 4   Examples of Predicted Versus Actual Demand Cont.

Model	Description	AIC	BIC
1	Proposed Model	9.78E+12	9.78E+12

Table 2   Model Comparison

4.2. Estimation
4.3. Model Comparison
4.4. Parameter Estimate

Table 3 reports posterior mean, standard deviation, and 95% highest probability density interval (HDPI) of the parameters in the proposed model averaged across all supplementary products. The parameter is significant if its HDPI does not include zero. Figure 5 illustrates histogram of goodwill elasticity of carry over, user base size, mean of rating, versioning shock, and short term economic shocks. The histogram indicate that goodwill elasticities of supplementary products are heterogeneous. If the model does not account for this heterogeneity, the estimation will become bias. We then tried to explain this hetrogeneity based on plug in characteristics.

Table 4 reports posterior mean, standard deviation and 95% HDPI of parameters of characteristics of product that explain heterogeneity. First, consider estimate of carryover effect. As we expected when the share of a dominant platform, Windows, increases forgetting rate would be lower. This finding can be attributed to the diffusion process. As size of the population increases the probability of exposure to consumers of the same type increases. This higher exposure during time will decrease decay, which is interpreted to forgetting in our model.

Goodwill elasticity to user base size is negatively affected by variance of rating. In other word, as uncertainty increases goodwill elasticity to user base size decreases. User base size is useful to consumers when consumers have unanimous valuation of product. When consumers are not unanimous in their valuation, the product will become a niche product. Niche products become problematic for consumers more in the context of experience goods, as consumer can only evaluate experience good after using it. We assume consumers are risk averse. As a result when rating becomes uninformative, bigger user base results decreases the good will of supplementary product.

Developer team size affects goodwill elasticity to rating valence negatively. This negative effect can be attributed to innovation and product quality. In other word, when consumers observe that a product is developed in a bigger team, their valuation for the product increases. Based on litrature as the size of firm increases innovation will increase. Moreover, as firm size increases it will have access to more resources, for example due to economics of scale. As a result the products developed in larger teams are more innovative, and of higher quality. Innovative products are defined by the niche market they are belonging to. Niche markets on the other hand is defined by small number of product substitutes. When consumers face a product that have less substitute they are prone to discount the rating, due to not having any other choice. Therefore, developer team size negatively

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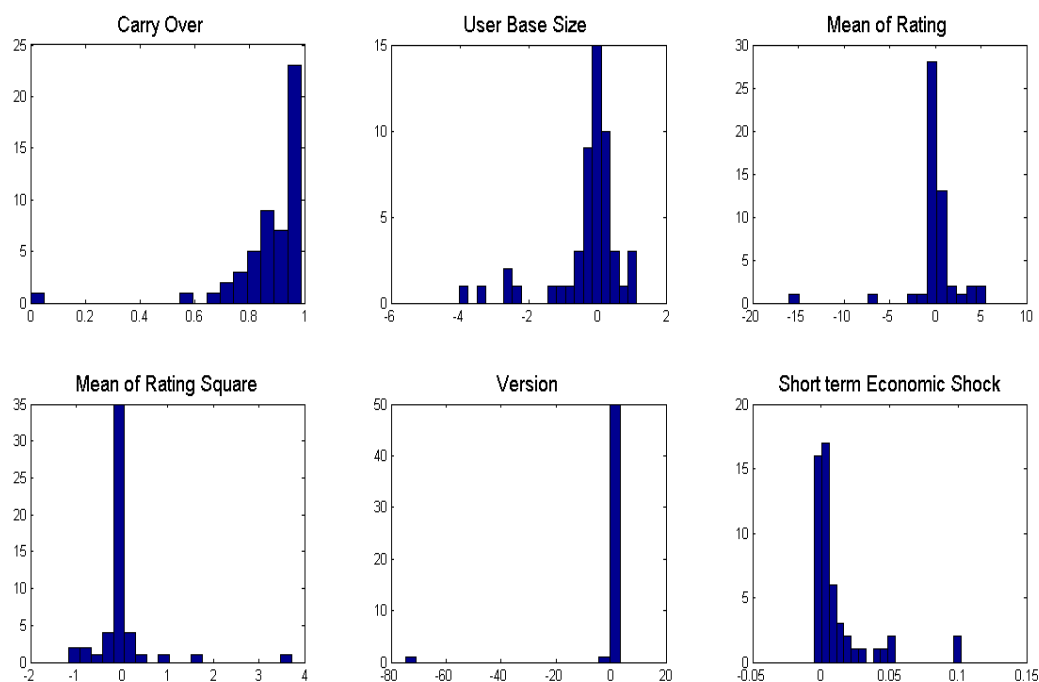
Figure 5   Histogram of Goodwill Elasticity across Supplementary Products

	Estimate	SD	2.5th Percentile	97.5th Percentile
Carry Over	0.878	0.158	0.835	0.921
User Base Size	-0.307	1.064	-0.596	-0.018
Mean of Rating	0.047	2.866	-0.732	0.826
Mean of Rating Square	0.009	0.651	-0.168	0.186
Version	0.629	2.986	-0.183	1.440
Short term Economic Shock	0.012	0.023	0.006	0.018
V	0.109	0.267	0.036	0.181
Weekend Dummy	-39.799	0.000	-39.799	-39.798
W	4.168	16.664	-0.361	8.697

Table 3   Mean Elasticity Parameter Estimate Across Supplementary Products

affects goodwill elasticity to rating.   Number of product reviews positively affects goodwill elasticity to short term economic shocks. This shocks either could be supply or demand shocks. Based on Litrature consumers self select themselves to review products that are important for them. Consequently, as products become important through short term economic shocks, consumers will review the product more, and this importance will affect goodwill elasticity to short term economic shocks positively.

5.   MANAGERIAL IMPLICATION
6.   CONCLUSION
References

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		Estimate	SD	2.5th Percentile	97.5th Percentile
Carry Over	Intercept	0.239	0.107	0.062	0.412
	Share of Windows	0.746	0.122	0.541	0.948
User Base Size	Intercept	0.402	0.400	-0.270	1.047
	Variance of Rating	-0.482	0.248	-0.889	-0.109
Mean of Rating	Intercept	1.989	0.939	0.416	3.506
	Developer Team Size	-1.318	0.549	-2.253	-0.441
Mean of Rating Square	Intercept	-0.426	0.201	-0.752	-0.076
	Developer Team Size	0.291	0.120	0.085	0.486
Short term Economic	Intercept	0.004	0.008	-0.009	0.018
Shock	Number of Reviews	0.000	0.000	0.000	0.000
M1		0.017	0.007	0.010	0.030
M2		1.378	0.540	0.710	2.410
M3		9.151	3.461	4.801	15.525
M4		0.465	0.162	0.253	0.775
M5		0.003	0.001	0.002	0.004

Table 4 Parameter Heterogeneity

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Supplementary Product	MAD	MSE
Firebug	2.168	9.257
Flagfox	0.729	2.097
Web developer	0.260	0.246
IE Tab	0.730	1.472
Test Pilot	0.072	0.044
User Agent Switcher	0.344	0.507
Stylish	1.099	12.367
Text Link	0.099	0.056
DownThemAll	0.999	3.196
FireFTP	0.599	0.863
AllYouTubeDownload	0.025	0.007
Personas Plus	3.329	104.469
MinimizeToTray revived	0.108	0.051
Status-4-Evar	0.069	0.078
Classic Compact Options	0.019	0.001
Scriptish	0.084	0.117
Google Shortcuts	0.320	0.335
Super Start	0.075	0.038
Print pages to Pdf	0.035	0.010
SkipScreen	0.313	0.990
ReminderFox	0.311	0.522
AutoPager	0.515	2.380
Iplex to ALLPlayer	0.027	0.006
Tilt 3D	0.038	0.029
Cheevos for Firefox	0.017	0.003
ImTranslator	1.171	5.030
Google Translator for Firefox	0.098	0.054
Quick Locale Switcher	0.070	0.012
gTranslate	0.120	0.054
New Tong Wen Tang	0.040	0.004
Romanian Language Pack	0.023	0.001
Locale Switcher	0.026	0.001
Adblock Plus	4.165	41.455
Adblock Edge	0.063	0.199
Password Exporter	0.075	0.012
Stealthy	0.133	0.129
FEBE	0.184	0.215
The Camelizer	0.022	0.005
ChatZilla	0.089	0.054
Thumbnail Zoom Plus	0.035	0.013
ProCon Latte Content Filter	0.049	0.005
New Tab Homepage	0.062	0.009
Screengrab	0.027	0.005
Greasemonkey	1.600	26.361
Flashblock	0.277	0.220
Session Manager	0.091	0.021
PDF Viewer	0.056	0.021
Add-on Compatibility Reporter	0.198	0.323
Secure Login	0.051	0.008
Nightly Tester Tools	0.128	0.106
Translate This!	0.024	0.005
Quick Maps	0.050	0.036

Table 5   Mean Absolute Deviation and Mean Square Error

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Supplementary Product		Estimate	SD	2.5th Percentile	97.5th Percentile
Firebug	Carry Over	0.76	0.023	0.727	0.801
	User Base Size	0.05	0.135	-0.177	0.273
	Mean of Rating	-16.03	3.082	-20.992	-11.029
	Mean of Rating Square	3.72	0.667	2.625	4.769
	Version	1.36	0.357	0.756	1.916
	Short term Econ. Shock	0.10	0.019	0.071	0.135
	V	0.68	0.359	0.261	1.373
	Weekend Dummy	-39.33	0.548	-40.247	-38.450
	W	8.36	0.647	7.190	9.288
Flagfox	Carry Over	0.92	0.010	0.907	0.941
	User Base Size	0.36	0.179	0.075	0.649
	Mean of Rating	3.81	3.637	-2.340	9.730
	Mean of Rating Square	-0.85	0.779	-2.144	0.454
	Version	0.16	0.227	-0.217	0.531
	Short term Econ. Shock	0.00	0.003	-0.002	0.008
	V	0.05	0.023	0.021	0.097
	Weekend Dummy	-39.33	0.548	-40.247	-38.450
	W	2.33	0.099	2.176	2.489
Web developer	Carry Over	0.73	0.025	0.692	0.776
	User Base Size	-0.08	0.110	-0.242	0.121
	Mean of Rating	1.02	0.177	0.723	1.314
	Mean of Rating Square	-0.18	0.033	-0.237	-0.124
	Version	0.36	0.721	-0.889	1.502
	Short term Econ. Shock	0.04	0.005	0.032	0.047
	V	0.03	0.008	0.016	0.042
	Weekend Dummy	-39.33	0.547	-40.252	-38.450
	W	0.44	0.025	0.397	0.481
IE Tab	Carry Over	0.99	0.005	0.981	0.997
	User Base Size	-0.02	0.058	-0.115	0.072
	Mean of Rating	-7.05	2.529	-11.136	-3.009
	Mean of Rating Square	1.68	0.601	0.713	2.650
	Version	0.77	0.541	-0.120	1.718
	Short term Econ. Shock	0.00	0.003	-0.008	0.003
	V	0.36	0.062	0.265	0.473
	Weekend Dummy	-39.33	0.548	-40.238	-38.452
	W	0.87	0.094	0.711	1.021
Test Pilot	Carry Over	0.82	0.009	0.803	0.834
	User Base Size	0.01	0.003	0.007	0.016
	Mean of Rating	-0.04	0.026	-0.086	0.001
	Mean of Rating Square	0.01	0.006	0.005	0.024
	Version	0.34	0.049	0.266	0.425
	Short term Econ. Shock	0.00	0.000	-0.001	0.001
	V	0.04	0.002	0.041	0.048
	Weekend Dummy	-39.33	0.548	-40.248	-38.438
	W	0.01	0.001	0.005	0.007
User Agent Switcher	Carry Over	0.86	0.013	0.840	0.883
	User Base Size	-0.31	0.217	-0.665	0.060
	Mean of Rating	0.21	0.230	-0.155	0.566
	Mean of Rating Square	-0.04	0.050	-0.113	0.045
	Version	-0.06	0.688	-1.217	1.103
	Short term Econ. Shock	0.02	0.002	0.017	0.026
	V	0.02	0.004	0.011	0.025
	Weekend Dummy	-39.33	0.548	-40.246	-38.438
	W	0.49	0.019	0.455	0.519

Table 6   Parameter Estimate Supplementary Products

Supplementary Product		Estimate	SD	2.5th Percentile	97.5th Percentile
Stylish	Carry Over	0.69	0.018	0.658	0.718
	User Base Size	1.15	0.467	0.377	1.875
	Mean of Rating	3.82	1.332	1.644	6.110
	Mean of Rating Square	-0.85	0.299	-1.373	-0.370
	Version	0.96	0.687	-0.208	2.134
	Short term Econ. Shock	0.05	0.008	0.041	0.066
	V	0.26	0.100	0.107	0.426
	Weekend Dummy	-39.33	0.548	-40.263	-38.451
	W	12.20	0.445	11.469	12.987
Text Link	Carry Over	0.77	0.018	0.741	0.802
	User Base Size	0.03	0.023	-0.009	0.066
	Mean of Rating	-0.10	0.136	-0.327	0.126
	Mean of Rating Square	0.02	0.031	-0.028	0.075
	Version	0.20	0.055	0.110	0.293
	Short term Econ. Shock	0.00	0.001	0.003	0.005
	V	0.01	0.002	0.008	0.013
	Weekend Dummy	-39.33	0.548	-40.267	-38.454
	W	0.04	0.003	0.037	0.047
DownThemAll	Carry Over	0.97	0.006	0.959	0.980
	User Base Size	-0.30	0.150	-0.556	-0.050
	Mean of Rating	-1.31	2.485	-5.433	2.692
	Mean of Rating Square	0.32	0.543	-0.550	1.227
	Version	0.85	0.351	0.276	1.420
	Short term Econ. Shock	0.01	0.004	0.007	0.019
	V	0.37	0.091	0.245	0.530
	Weekend Dummy	-39.33	0.548	-40.245	-38.460
	W	2.57	0.182	2.263	2.853
FireFTP	Carry Over	0.92	0.011	0.899	0.936
	User Base Size	-0.47	0.122	-0.676	-0.280
	Mean of Rating	5.12	1.021	3.403	6.784
	Mean of Rating Square	-1.16	0.236	-1.553	-0.759
	Version	0.07	0.194	-0.238	0.384
	Short term Econ. Shock	0.03	0.004	0.024	0.039
	V	0.07	0.027	0.033	0.117
	Weekend Dummy	-39.33	0.548	-40.243	-38.453
	W	0.75	0.052	0.661	0.833
AllYouTubeDownload	Carry Over	0.97	0.008	0.960	0.985
	User Base Size	0.02	0.049	-0.064	0.094
	Mean of Rating	0.02	0.023	-0.021	0.057
	Mean of Rating Square	0.00	0.005	-0.011	0.005
	Version	-0.02	0.051	-0.104	0.067
	Short term Econ. Shock	0.00	0.000	-0.001	0.000
	V	0.00	0.000	0.002	0.002
	Weekend Dummy	-39.33	0.548	-40.247	-38.452
	W	0.01	0.001	0.009	0.011
Personas Plus	Carry Over	0.88	0.012	0.865	0.905
	User Base Size	-0.08	0.423	-0.769	0.636
	Mean of Rating	-2.81	1.036	-4.537	-1.043
	Mean of Rating Square	0.80	0.252	0.390	1.224
	Version	-0.31	2.176	-3.922	3.258
	Short term Econ. Shock	0.10	0.026	0.054	0.141
	V	0.10	0.100	0.011	0.299
	Weekend Dummy	-39.33	0.548	-40.249	-38.453
	W	112.61	4.044	105.940	119.417

Table 7   Parameter Estimate Supplementary Products Cont.

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Supplementary Product		Estimate	SD	2.5th Percentile	97.5th Percentile
MinimizeToTray	Carry Over	0.92	0.012	0.897	0.935
revived	User Base Size	0.14	0.121	-0.066	0.329
	Mean of Rating	0.38	0.133	0.153	0.602
	Mean of Rating Square	-0.08	0.029	-0.131	-0.033
	Version	0.19	0.070	0.075	0.303
	Short term Econ. Shock	0.00	0.001	0.001	0.005
	V	0.01	0.001	0.004	0.007
	Weekend Dummy	-39.33	0.548	-40.250	-38.458
	W	0.05	0.003	0.048	0.056
Status-4-Evar	Carry Over	0.86	0.015	0.838	0.885
	User Base Size	0.91	0.280	0.452	1.378
	Mean of Rating	0.47	0.193	0.152	0.781
	Mean of Rating Square	-0.12	0.040	-0.186	-0.055
	Version	0.13	0.062	0.029	0.237
	Short term Econ. Shock	0.01	0.002	0.009	0.016
	V	0.00	0.001	0.003	0.007
	Weekend Dummy	-39.33	0.548	-40.248	-38.457
	W	0.13	0.006	0.120	0.139
Classic Compact	Carry Over	0.92	0.011	0.902	0.937
Options	User Base Size	0.03	0.016	0.007	0.060
	Mean of Rating	0.02	0.013	-0.005	0.037
	Mean of Rating Square	0.00	0.003	-0.008	0.001
	Version	0.03	0.012	0.008	0.047
	Short term Econ. Shock	0.00	0.000	0.000	0.000
	V	0.00	0.000	0.000	0.001
	Weekend Dummy	-39.33	0.548	-40.247	-38.458
	W	0.00	0.000	0.000	0.001
Scriptish	Carry Over	0.87	0.016	0.847	0.899
	User Base Size	0.26	0.421	-0.419	0.946
	Mean of Rating	-0.01	0.191	-0.338	0.301
	Mean of Rating Square	0.00	0.040	-0.063	0.071
	Version	-0.02	0.147	-0.260	0.215
	Short term Econ. Shock	0.00	0.001	0.002	0.007
	V	0.01	0.001	0.004	0.009
	Weekend Dummy	-39.33	0.549	-40.254	-38.456
	W	0.19	0.009	0.179	0.210
Google Shortcuts	Carry Over	0.96	0.007	0.943	0.967
	User Base Size	-0.21	0.188	-0.504	0.117
	Mean of Rating	0.84	0.194	0.524	1.161
	Mean of Rating Square	-0.21	0.045	-0.284	-0.134
	Version	0.27	0.077	0.147	0.392
	Short term Econ. Shock	0.01	0.001	0.004	0.009
	V	0.13	0.010	0.111	0.144
	Weekend Dummy	-39.33	0.549	-40.254	-38.445
	W	0.14	0.013	0.120	0.161
Super Start	Carry Over	0.94	0.013	0.923	0.966
	User Base Size	0.34	0.523	-0.543	1.221
	Mean of Rating	-0.40	0.122	-0.600	-0.199
	Mean of Rating Square	0.09	0.025	0.046	0.127
	Version	0.07	0.069	-0.044	0.181
	Short term Econ. Shock	0.00	0.003	0.000	0.009
	V	0.02	0.004	0.015	0.028
	Weekend Dummy	-39.33	0.549	-40.251	-38.447
	W	0.06	0.007	0.046	0.068

Table 8   Parameter Estimate Supplementary Products Cont.

Supplementary Product		Estimate	SD	2.5th Percentile	97.5th Percentile
Print pages	Carry Over	0.96	0.013	0.942	0.984
to Pdf	User Base Size	-0.53	0.392	-1.165	0.090
	Mean of Rating	0.20	0.088	0.062	0.349
	Mean of Rating Square	-0.04	0.018	-0.073	-0.014
	Version	0.10	0.061	-0.001	0.209
	Short term Econ. Shock	0.00	0.001	-0.001	0.002
	V	0.01	0.001	0.006	0.010
	Weekend Dummy	-39.33	0.549	-40.253	-38.444
	W	0.02	0.002	0.019	0.026
SkipScreen	Carry Over	0.82	0.015	0.798	0.847
	User Base Size	-1.04	0.215	-1.392	-0.679
	Mean of Rating	0.24	0.359	-0.364	0.847
	Mean of Rating Square	-0.03	0.085	-0.171	0.113
	Version	-0.07	0.212	-0.417	0.271
	Short term Econ. Shock	0.03	0.004	0.021	0.034
	V	0.04	0.010	0.025	0.056
	Weekend Dummy	-39.33	0.549	-40.277	-38.443
	W	1.03	0.043	0.956	1.098
ReminderFox	Carry Over	0.88	0.012	0.863	0.904
	User Base Size	0.33	0.271	-0.125	0.763
	Mean of Rating	-0.05	0.863	-1.475	1.380
	Mean of Rating Square	0.01	0.195	-0.311	0.329
	Version	0.08	0.151	-0.158	0.328
	Short term Econ. Shock	0.01	0.001	0.006	0.010
	V	0.03	0.012	0.013	0.052
	Weekend Dummy	-39.33	0.549	-40.280	-38.456
	W	0.48	0.025	0.438	0.521
AutoPager	Carry Over	0.97	0.006	0.958	0.980
	User Base Size	-0.22	0.341	-0.795	0.350
	Mean of Rating	3.03	0.778	1.788	4.356
	Mean of Rating Square	-0.64	0.167	-0.929	-0.381
	Version	-0.82	0.242	-1.205	-0.420
	Short term Econ. Shock	0.00	0.003	0.000	0.009
	V	0.09	0.043	0.032	0.173
	Weekend Dummy	-39.33	0.548	-40.260	-38.455
	W	2.24	0.109	2.065	2.426
Iplex to	Carry Over	0.82	0.024	0.781	0.860
ALLPlayer	User Base Size	-0.09	0.045	-0.162	-0.015
	Mean of Rating	0.08	0.038	0.014	0.140
	Mean of Rating Square	-0.02	0.012	-0.038	0.002
	Version	-74.77	2531.072	-4078.763	4098.514
	Short term Econ. Shock	0.00	0.001	0.001	0.003
	V	0.00	0.000	0.002	0.004
	Weekend Dummy	-39.33	0.548	-40.260	-38.459
	W	0.01	0.001	0.011	0.014
Tilt 3D	Carry Over	0.78	0.044	0.704	0.847
	User Base Size	-0.47	1.163	-2.326	1.392
	Mean of Rating	-0.28	0.083	-0.424	-0.148
	Mean of Rating Square	0.05	0.016	0.026	0.080
	Version	0.12	0.172	-0.163	0.406
	Short term Econ. Shock	0.01	0.002	0.006	0.014
	V	0.03	0.006	0.023	0.042
	Weekend Dummy	-39.33	0.548	-40.275	-38.463
	W	0.03	0.007	0.022	0.046

Table 9   Parameter Estimate Supplementary Products Cont.

Meisam Hejazinia: *Dynamic Effect of Supplementary Product Rating*
Paper submitted for first year summer paper; August 28/2013

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Supplementary Product		Estimate	SD	2.5th Percentile	97.5th Percentile
Cheevos	Carry Over	0.97	0.012	0.948	0.989
for Firefox	User Base Size	-1.31	1.318	-3.463	0.638
	Mean of Rating	0.08	0.056	-0.017	0.171
	Mean of Rating Square	-0.01	0.011	-0.033	0.005
	Version	-0.02	0.040	-0.083	0.051
	Short term Econ. Shock	0.00	0.002	-0.003	0.002
	V	0.00	0.000	0.002	0.003
	Weekend Dummy	-39.33	0.548	-40.267	-38.463
	W	0.01	0.001	0.005	0.007
ImTranslator	Carry Over	0.89	0.012	0.868	0.907
	User Base Size	0.18	0.260	-0.254	0.626
	Mean of Rating	1.60	0.451	0.868	2.340
	Mean of Rating Square	-0.34	0.089	-0.487	-0.197
	Version	1.32	0.361	0.710	1.911
	Short term Econ. Shock	0.01	0.005	-0.002	0.014
	V	0.05	0.024	0.021	0.097
	Weekend Dummy	-39.33	0.548	-40.259	-38.467
	W	5.02	0.182	4.729	5.329
Google Translator	Carry Over	0.91	0.012	0.894	0.935
for Firefox	User Base Size	0.50	0.134	0.271	0.711
	Mean of Rating	0.32	0.081	0.194	0.462
	Mean of Rating Square	-0.05	0.015	-0.079	-0.029
	Version	0.05	0.084	-0.088	0.184
	Short term Econ. Shock	0.00	0.001	-0.007	-0.003
	V	0.01	0.002	0.006	0.011
	Weekend Dummy	-39.33	0.547	-40.256	-38.464
	W	0.06	0.004	0.051	0.062
Quick Locale	Carry Over	0.82	0.329	0.003	0.969
Switcher	User Base Size	0.67	1.219	0.063	3.931
	Mean of Rating	-0.50	0.931	-2.869	-0.071
	Mean of Rating Square	0.11	0.204	0.015	0.625
	Version	-0.01	0.035	-0.064	0.041
	Short term Econ. Shock	0.00	0.005	0.000	0.017
	V	0.01	0.019	0.005	0.060
	Weekend Dummy	-39.33	0.548	-40.260	-38.474
	W	0.01	0.004	0.004	0.012
gTranslate	Carry Over	0.96	0.010	0.939	0.971
	User Base Size	-0.27	0.167	-0.539	-0.002
	Mean of Rating	0.04	0.045	-0.034	0.117
	Mean of Rating Square	0.00	0.010	-0.019	0.014
	Version	0.12	0.091	-0.025	0.278
	Short term Econ. Shock	0.00	0.000	0.000	0.000
	V	0.03	0.002	0.024	0.030
	Weekend Dummy	-39.33	0.548	-40.280	-38.477
	W	0.01	0.002	0.012	0.018
New Tong	Carry Over	0.97	0.006	0.957	0.977
Wen Tang	User Base Size	0.42	0.145	0.181	0.646
	Mean of Rating	-0.02	0.009	-0.036	-0.007
	Mean of Rating Square	0.00	0.002	0.001	0.007
	Version	0.01	0.021	-0.022	0.048
	Short term Econ. Shock	0.00	0.000	0.000	0.001
	V	0.00	0.000	0.002	0.002
	Weekend Dummy	-39.33	0.548	-40.276	-38.474
	W	0.00	0.000	0.002	0.002

Table 10   Parameter Estimate Supplementary Products Cont.

Supplementary Product		Estimate	SD	2.5th Percentile	97.5th Percentile
Romanian	Carry Over	0.00	0.000	0.000	0.001
Language Pack	User Base Size	0.90	0.060	0.804	1.000
	Mean of Rating	0.03	0.010	0.010	0.045
	Mean of Rating Square	-0.01	0.002	-0.010	-0.002
	Version	0.00	0.018	-0.025	0.032
	Short term Econ. Shock	0.00	0.000	0.000	0.000
	V	0.00	0.000	0.001	0.001
	Weekend Dummy	-39.33	0.548	-40.275	-38.473
	W	0.00	0.000	0.001	0.001
Locale Switcher	Carry Over	0.96	0.007	0.949	0.973
	User Base Size	0.15	0.078	0.022	0.273
	Mean of Rating	-0.01	0.007	-0.018	0.004
	Mean of Rating Square	0.00	0.002	-0.001	0.004
	Version	-0.01	0.039	-0.077	0.051
	Short term Econ. Shock	0.00	0.000	0.000	0.000
	V	0.00	0.000	0.001	0.001
	Weekend Dummy	-39.33	0.548	-40.275	-38.471
	W	0.00	0.000	0.001	0.001
Adblock Plus	Carry Over	0.91	0.011	0.889	0.924
	User Base Size	0.21	0.061	0.110	0.310
	Mean of Rating	5.57	6.138	-4.692	15.321
	Mean of Rating Square	-0.97	1.282	-2.978	1.179
	Version	3.48	1.194	1.474	5.386
	Short term Econ. Shock	0.05	0.016	0.024	0.077
	V	3.24	1.090	1.382	4.930
	Weekend Dummy	-39.33	0.549	-40.237	-38.450
	W	36.47	2.191	33.064	40.204
Adblock Edge	Carry Over	0.89	0.038	0.821	0.951
	User Base Size	-3.30	2.082	-6.745	0.230
	Mean of Rating	-0.40	0.406	-1.069	0.244
	Mean of Rating Square	0.17	0.083	0.033	0.301
	Version	0.21	0.566	-0.748	1.112
	Short term Econ. Shock	0.01	0.020	-0.020	0.046
	V	0.06	0.031	0.012	0.116
	Weekend Dummy	-39.33	0.549	-40.223	-38.447
	W	1.23	0.125	1.028	1.437
Password Exporter	Carry Over	0.94	0.010	0.925	0.958
	User Base Size	0.04	0.091	-0.111	0.195
	Mean of Rating	0.07	0.037	0.016	0.135
	Mean of Rating Square	-0.02	0.010	-0.032	0.000
	Version	-0.04	0.047	-0.121	0.034
	Short term Econ. Shock	0.00	0.000	0.000	0.001
	V	0.00	0.000	0.004	0.005
	Weekend Dummy	-39.33	0.549	-40.220	-38.445
	W	0.00	0.001	0.004	0.006
Stealthy	Carry Over	0.73	0.034	0.670	0.786
	User Base Size	-2.62	0.542	-3.528	-1.737
	Mean of Rating	0.44	0.126	0.240	0.650
	Mean of Rating Square	-0.10	0.030	-0.149	-0.051
	Version	-0.08	0.158	-0.334	0.193
	Short term Econ. Shock	0.02	0.002	0.013	0.021
	V	0.05	0.017	0.027	0.084
	Weekend Dummy	-39.33	0.549	-40.213	-38.459
	W	0.18	0.025	0.137	0.222
	Carry Over	0.98	0.005	0.977	0.992

Table 11   Parameter Estimate Supplementary Products Cont.

Supplementary Product		Estimate	SD	2.5th Percentile	97.5th Percentile
FEBE	User Base Size	-0.25	0.130	-0.463	-0.045
	Mean of Rating	0.81	0.358	0.241	1.394
	Mean of Rating Square	-0.19	0.084	-0.329	-0.058
	Version	-0.09	0.094	-0.249	0.059
	Short term Econ. Shock	0.00	0.001	0.001	0.004
	V	0.09	0.007	0.080	0.102
	Weekend Dummy	-39.33	0.549	-40.224	-38.459
	W	0.08	0.007	0.066	0.090
The Camelizer	Carry Over	0.56	0.172	0.052	0.658
	User Base Size	-4.02	1.360	-6.638	-2.069
	Mean of Rating	0.05	0.022	0.014	0.086
	Mean of Rating Square	0.00	0.004	-0.010	0.002
	Version	0.01	0.029	-0.036	0.059
	Short term Econ. Shock	0.00	0.000	-0.001	0.000
	V	0.00	0.000	0.001	0.003
	Weekend Dummy	-39.33	0.549	-40.227	-38.459
	W	0.00	0.001	0.004	0.007
ChatZilla	Carry Over	0.96	0.006	0.947	0.966
	User Base Size	-0.13	0.135	-0.347	0.091
	Mean of Rating	-0.09	0.089	-0.234	0.057
	Mean of Rating Square	0.02	0.020	-0.011	0.055
	Version	-0.04	0.065	-0.151	0.060
	Short term Econ. Shock	0.00	0.001	0.002	0.004
	V	0.02	0.002	0.022	0.027
	Weekend Dummy	-39.33	0.549	-40.217	-38.462
	W	0.02	0.002	0.015	0.021
Thumbnail	Carry Over	0.95	0.015	0.922	0.974
Zoom Plus	User Base Size	0.30	0.304	-0.190	0.832
	Mean of Rating	0.05	0.064	-0.055	0.156
	Mean of Rating Square	-0.01	0.013	-0.027	0.015
	Version	0.04	0.028	-0.011	0.082
	Short term Econ. Shock	0.00	0.002	-0.004	0.001
	V	0.01	0.002	0.009	0.016
	Weekend Dummy	-39.33	0.549	-40.210	-38.469
	W	0.02	0.003	0.012	0.020
ProCon Latte	Carry Over	0.96	0.008	0.950	0.975
Content Filter	User Base Size	-0.22	0.097	-0.379	-0.060
	Mean of Rating	0.12	0.037	0.058	0.181
	Mean of Rating Square	-0.03	0.008	-0.039	-0.012
	Version	0.06	0.032	0.008	0.111
	Short term Econ. Shock	0.00	0.000	0.000	0.000
	V	0.00	0.000	0.002	0.003
	Weekend Dummy	-39.33	0.549	-40.209	-38.472
	W	0.00	0.000	0.002	0.002
New Tab	Carry Over	0.95	0.009	0.939	0.967
Homepage	User Base Size	0.09	0.079	-0.033	0.226
	Mean of Rating	0.07	0.032	0.017	0.125
	Mean of Rating Square	-0.01	0.007	-0.027	-0.003
	Version	0.10	0.056	0.012	0.195
	Short term Econ. Shock	0.00	0.000	0.000	0.001
	V	0.00	0.000	0.002	0.003
	Weekend Dummy	-39.33	0.549	-40.209	-38.473
	W	0.01	0.000	0.005	0.007

Table 12   Parameter Estimate Supplementary Products Cont.

Supplementary Product		Estimate	SD	2.5th Percentile	97.5th Percentile
Screengrab	Carry Over	0.90	0.018	0.874	0.932
	User Base Size	0.37	0.223	-0.001	0.733
	Mean of Rating	-0.19	0.059	-0.286	-0.094
	Mean of Rating Square	0.04	0.013	0.016	0.058
	Version	0.08	0.032	0.029	0.135
	Short term Econ. Shock	0.00	0.001	0.003	0.005
	V	0.00	0.001	0.003	0.004
	Weekend Dummy	-39.33	0.549	-40.207	-38.466
	W	0.01	0.001	0.010	0.014
Greasemonkey	Carry Over	0.88	0.013	0.860	0.900
	User Base Size	-0.02	0.270	-0.461	0.435
	Mean of Rating	1.96	3.237	-3.429	6.985
	Mean of Rating Square	-0.38	0.744	-1.549	0.848
	Version	0.31	0.724	-0.879	1.521
	Short term Econ. Shock	0.05	0.009	0.034	0.063
	V	0.98	0.337	0.472	1.571
	Weekend Dummy	-39.33	0.548	-40.255	-38.453
	W	25.02	1.078	23.297	26.769
Flashblock	Carry Over	0.89	0.011	0.868	0.907
	User Base Size	-0.10	0.054	-0.193	-0.018
	Mean of Rating	-0.56	0.593	-1.581	0.421
	Mean of Rating Square	0.16	0.135	-0.062	0.392
	Version	0.28	0.120	0.080	0.471
	Short term Econ. Shock	0.00	0.002	0.001	0.008
	V	0.04	0.006	0.029	0.049
	Weekend Dummy	-39.33	0.548	-40.260	-38.459
	W	0.16	0.011	0.141	0.179
Session Manager	Carry Over	0.98	0.006	0.967	0.987
	User Base Size	-0.22	0.089	-0.374	-0.074
	Mean of Rating	-0.06	0.078	-0.190	0.061
	Mean of Rating Square	0.02	0.019	-0.012	0.048
	Version	0.01	0.012	-0.007	0.033
	Short term Econ. Shock	0.00	0.000	0.000	0.001
	V	0.01	0.001	0.009	0.011
	Weekend Dummy	-39.33	0.548	-40.262	-38.459
	W	0.01	0.001	0.006	0.008
PDF Viewer	Carry Over	0.97	0.011	0.956	0.993
	User Base Size	-0.35	0.251	-0.744	0.071
	Mean of Rating	0.17	0.072	0.047	0.284
	Mean of Rating Square	-0.04	0.013	-0.057	-0.012
	Version	0.21	0.072	0.089	0.322
	Short term Econ. Shock	0.00	0.003	-0.006	0.005
	V	0.01	0.001	0.004	0.008
	Weekend Dummy	-39.33	0.548	-40.264	-38.458
	W	0.05	0.004	0.048	0.061
Add-on Compatibility Reporter	Carry Over	0.94	0.010	0.926	0.957
	User Base Size	0.49	0.207	0.158	0.830
	Mean of Rating	-0.01	0.090	-0.166	0.130
	Mean of Rating Square	-0.02	0.022	-0.054	0.019
	Version	0.19	0.120	-0.010	0.393
	Short term Econ. Shock	0.01	0.003	0.005	0.016
	V	0.01	0.005	0.006	0.022
	Weekend Dummy	-39.33	0.548	-40.257	-38.454
	W	0.39	0.017	0.364	0.420

Table 13   Parameter Estimate Supplementary Products Cont.

Supplementary Product		Estimate	SD	2.5th Percentile	97.5th Percentile
Secure Login	Carry Over	0.98	0.005	0.973	0.989
	User Base Size	-0.11	0.091	-0.255	0.040
	Mean of Rating	0.06	0.040	-0.006	0.126
	Mean of Rating Square	-0.01	0.010	-0.030	0.002
	Version	0.03	0.028	-0.012	0.075
	Short term Econ. Shock	0.00	0.000	0.000	0.001
	V	0.00	0.000	0.004	0.004
	Weekend Dummy	-39.33	0.548	-40.258	-38.454
	W	0.00	0.000	0.002	0.003
Nightly	Carry Over	0.81	0.015	0.784	0.833
Tester Tools	User Base Size	-0.82	0.622	-1.877	0.160
	Mean of Rating	0.12	0.071	0.005	0.239
	Mean of Rating Square	-0.04	0.017	-0.069	-0.011
	Version	0.29	0.077	0.163	0.419
	Short term Econ. Shock	0.01	0.001	0.008	0.013
	V	0.01	0.002	0.005	0.011
	Weekend Dummy	-39.33	0.548	-40.265	-38.455
	W	0.10	0.004	0.090	0.104
Translate	Carry Over	0.98	0.006	0.970	0.991
This!	User Base Size	-2.57	0.516	-3.417	-1.730
	Mean of Rating	0.20	0.040	0.132	0.268
	Mean of Rating Square	-0.04	0.008	-0.050	-0.024
	Version	0.11	0.037	0.044	0.167
	Short term Econ. Shock	0.00	0.001	-0.003	0.000
	V	0.00	0.000	0.002	0.003
	Weekend Dummy	-39.33	0.548	-40.261	-38.455
	W	0.01	0.001	0.007	0.009
Quick Maps	Carry Over	0.95	0.014	0.928	0.975
	User Base Size	-2.46	1.252	-4.535	-0.352
	Mean of Rating	0.20	0.118	0.004	0.391
	Mean of Rating Square	-0.04	0.022	-0.072	0.003
	Version	0.02	0.194	-0.315	0.334
	Short term Econ. Shock	0.00	0.002	-0.002	0.004
	V	0.02	0.004	0.008	0.022
	Weekend Dummy	-39.33	0.548	-40.264	-38.459
	W	0.09	0.009	0.074	0.103

Table 14   **Parameter Estimate Supplementary Products Cont.**