The life cycle of social media

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Abstract

Using weekly data on the interest for 17 social media via Google trends and using quarterly data on actual users for 3 social media, it is reported in this letter that the life cycles of social media mimic those of durable consumer goods. On average, the popularity of social media peaks after 4 years since entry.

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Introduction

This letter deals with the life cycle of social media. Using weekly data on the interest for social media via Google trends and also using data on actual users for a few social media, it is examined if the life cycles of social media mimic those of durable consumer goods. Using versions of the familiar Bass (1969) model, the data for 17 social media are studied.

The next section deals with the weekly data Google trends data, while the subsequent section analyzes lower frequency data on actual users. The Bass model fits all data rather well, and the last section summarizes a few of the key properties of social media. The main conclusion is that the popularity of social media on average peaks after about four years.

Weekly Google trends data

The weekly index of interest for social media is available since January 2004 through Google Trends. The data for 17 prominent social media in Figures 1 and 2 shows that interest displays a hump-shaped pattern while cumulative interest obeys a familiar S-shaped pattern, respectively. These patterns are very similar to the life cycle patterns of durable products. A statistical model to describe such patterns is the Bass (1969) model[1], and it allows the estimation of the degree of innovation by the adopters (labeled as P), the degree of imitation (Q), the ultimate level of maturity (M) (cumulative sales, or here: cumulative popularity), and the moment of peak attention (sales).

The Bass model assumes that the cumulative popularity can be described by

$$F(t) = M\,\frac{1-\exp(-(P+Q)t)}{1+\frac{Q}{P}\exp(-(P+Q)t)}$$

where t = 1,2,.., T, which implies a peak moment equal to $T_{peak} = \frac{1}{P+Q}\log\frac{Q}{P}$.

To estimate the P, Q and M parameters for high frequency data (like weekly data), it is appropriate to allow for autoregressive dynamics as recommended by Boswijk and Franses (2005). This amounts to considering the following regression model for adoptions y_t and cumulative adoptions cy_t, that is,

[1] See for a related model applied to Facebook data: http://arxiv.org/pdf/1401.4208v1.pdf

$$y_t = PM + (Q - P)cy_{t-1} - \frac{Q}{M} cy_{t-1}^2 + u_t$$

with $u_t = \rho u_{t-1} + \varepsilon_t$

The parameters in this model are estimated for the samples collected in Table 1, and the estimates (with standard errors) are presented in Table 2. The model fit each time is close to 1, standard errors are relatively small, and it is clear that the 17 social media show strong similarities[2]. The estimates for ρ range from around 0.75 to 0.97, and they are all significant at the 5% level.

Quarterly data on actual users

To examine if the Google trends data somehow match with the data on actual users, consider the quarterly data in Figure 3 for three popular social media. For these low frequency data there appear to be no need to estimate the autoregressive parameter ρ and hence it is fixed at 0. The parameter estimates are presented in Table 3. Generally, the Bass model fits these quarterly quite well, and the peak dates of these three social media range between 9 and 13 quarters, which is slightly less than the approximate 4 years (mean is 219 weeks) in Table 2.

Correlations between parameters

The graphs in Figures 4 to 6 indicate that older social media peaked later, while more recent social media reach peak success earlier and hence also disappear earlier. Older social media reach higher maturity levels, while more recent social media are less successful. More recent social media have a much higher degree of imitation than older social media have.

Conclusion

On average the popularity peak of social media is attained after 219 weeks, which is about four years. And, within 2 to 4 years from now, many of these 17 social media will have popularity close to 0.

[2] To test for potential changing parameters P and Q an auxiliary regression is run of the residuals on a constant and the variables $trend * cy_{t-1}$ and $trend * cy_{t-1}^2$. Only in case of Picasa the p value is smaller than 0.05 (that is, 0.0242), and hence it seems that the parameters are constant throughout the estimation sample.

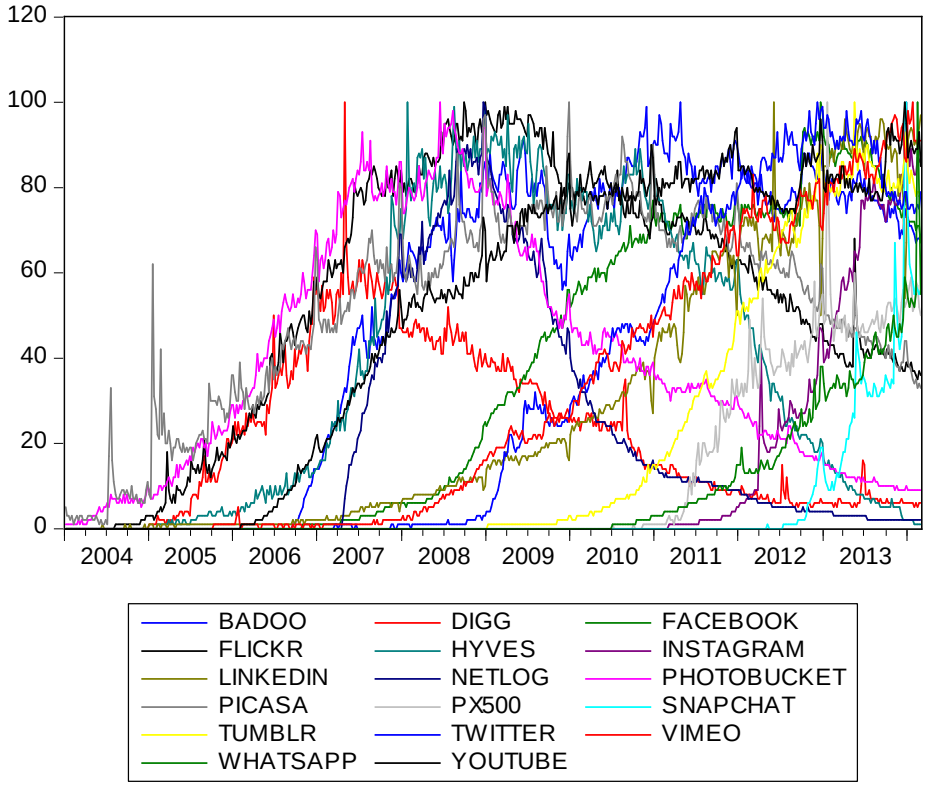

Figure 1: Weekly interest in 17 social media

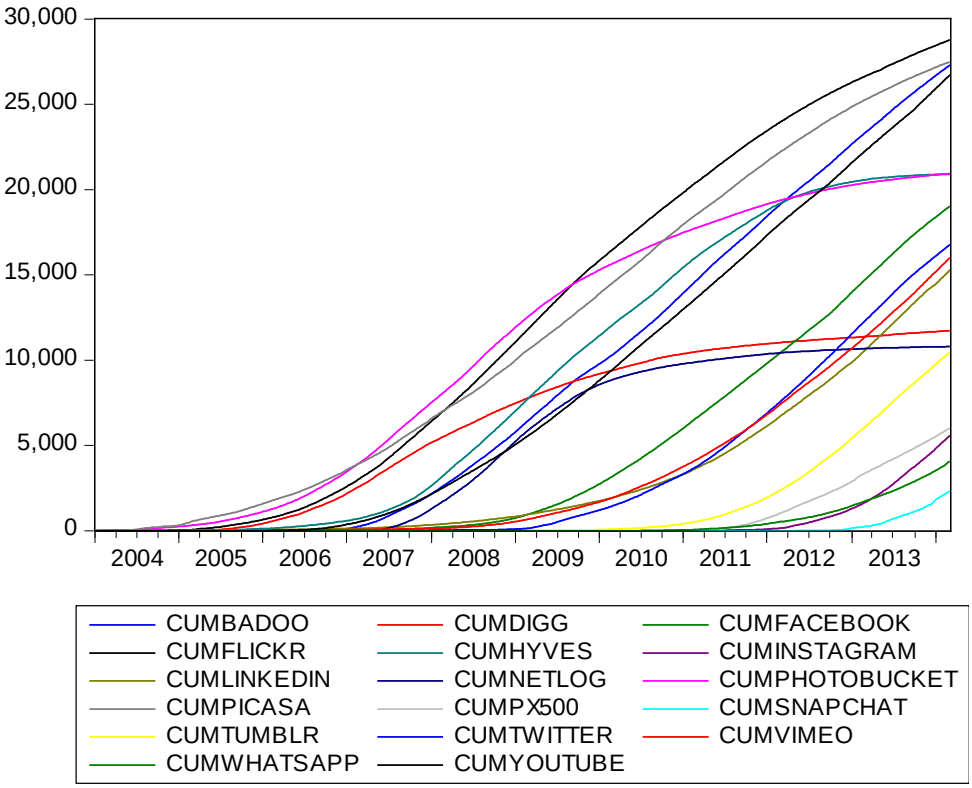

Figure 2: Cumulative interest (weekly observed) in 17 social media

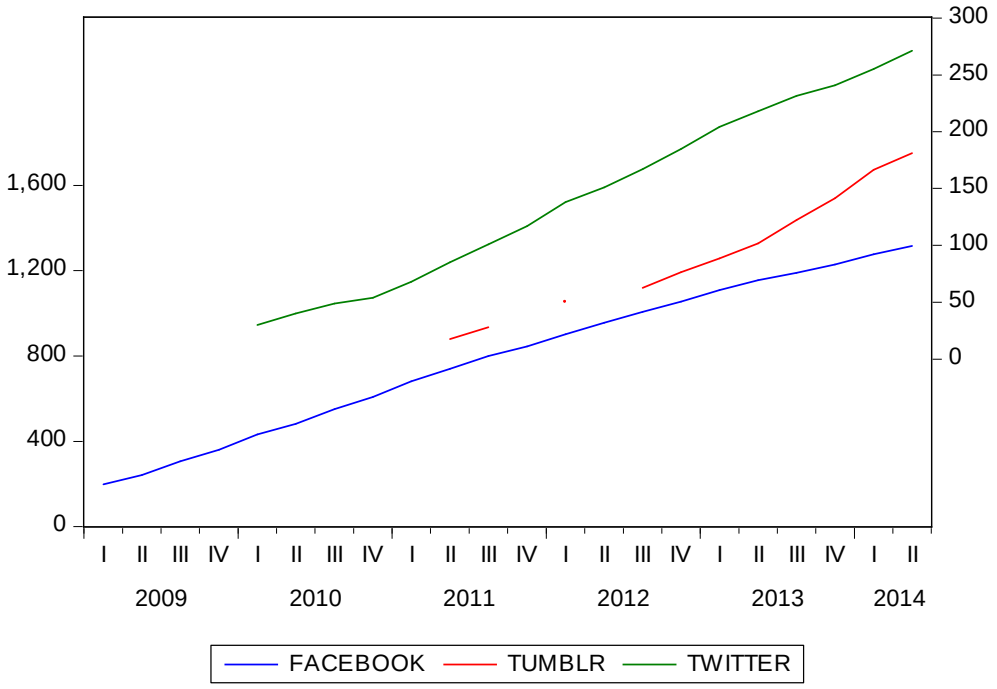

Figure 3: Quarterly data on actual users (in millions per month) of three popular social media (left axis is for Facebook, the right axis for the other two). Data source: www.statista.com, data retrieved on 19 September 2014.

Table 1: First non-zero entry in Google search items and amount of weekly observations (recorded on March 3 2014)

Badoo	9/18/2006	390
500PX	7/05/2010	192
Digg	1/3/2005	479
Facebook	10/30/2006	384
Flickr	8/09/2004	500
Hyves	2/07/2005	474
Instagram	3/07/2011	157
Linkedin	6/14/2004	510
Netlog	4/23/2007	359
Photobucket	1/5/2004	530
Picasa	1/5/2004	530
Snapchat	5/7/2012	96
Tumblr	1/12/2009	269
Twitter	3/19/2007	364
Vimeo	10/10/2005	439
Whatsapp	7/5/2010	192
Youtube	2/6/2006	422

Table 2: Estimation results for the Bass model (estimated standard errors in parentheses) for the weekly Google Trends data

	P (innovation) (x1000)		Q (imitation) (x1000)		M (maturity)		Peak
Badoo	1.122	(0.017)	6.255	(1.304)	39743	(3975)	233
500PX	0.895	(0.284)	24.32	(2.611)	8425	(642)	131
Digg	1.390	(0.026)	14.52	(1.105)	11620	(137)	147
Facebook	0.510	(0.025)	12.30	(1.617)	26093	(1778)	248
Flickr	0.797	(0.232)	10.04	(1.172)	31395	(991)	234
Hyves	0.618	(0.299)	16.19	(1.484)	21391	(400)	194
Instagram	0.386	(0.156)	35.10	(1.958)	9519	(578)	127
Linkedin	0.051	(0.024)	13.38	(0.327)	26392	(769)	415
Netlog	3.942	(0.068)	21.16	(2.037)	10623	(86)	66.9
Photobucket	0.742	(0.274)	13.88	(1.259)	21062	(345)	200
Picasa	0.454	(0.048)	9.279	(0.288)	31449	(365)	310
Snapchatr	0.744	(0.708)	51.73	(9.564)	4374	(1043)	80.8
Tumblr	0.253	(0.088)	23.77	(0.872)	14653	(394)	189
Twitter	0.296	(0.109)	16.08	(0.952)	22812	(843)	244
Vimeo	0.169	(0.060)	12.69	(0.749)	27358	(1714)	336
Whatsapp	0.153	(0.086)	17.22	(1.727)	26995	(17636)	272
Youtube	0.695	(0.015)	7.420	(1.226)	40240	(4064)	292
Mean	0.777		17.96		22010		219
Median	0.618		14.52		22811		233

Table 3: Estimation results for the Bass model (estimated standard errors in parentheses) for the quarterly data on users.

	P (innovation) (x1000)		Q (imitation) (x1000)		M (maturity)		Peak
Facebook	28.18	(3.511)	73.25	(22.85)	1723	(148)	9.4
Tumblr	18.13	(17.13)	223.6	(98.76)	279	(65)	10.4
Twitter	13.84	(8.645)	177.5	(46.65)	334	(33.7)	13

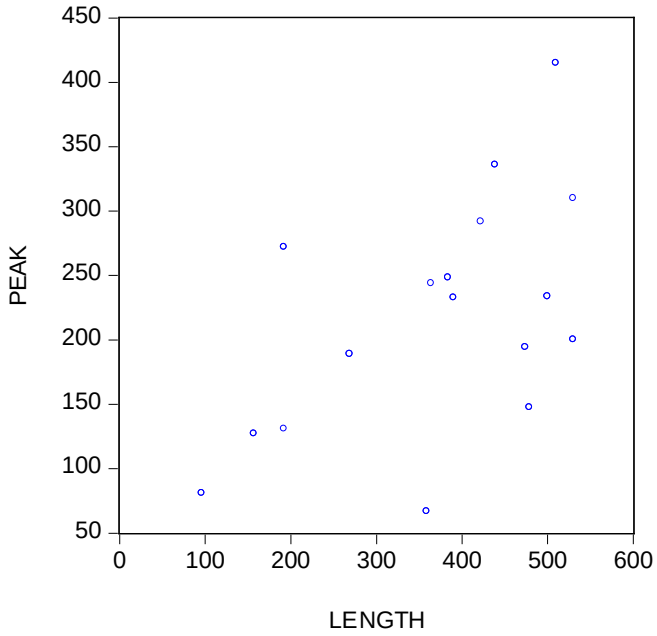

Figure 4: Older social media peaked later, while more recent social media reach peak success earlier and hence also disappear earlier. Regression line has slope 0.356 with estimated standard error 0.143

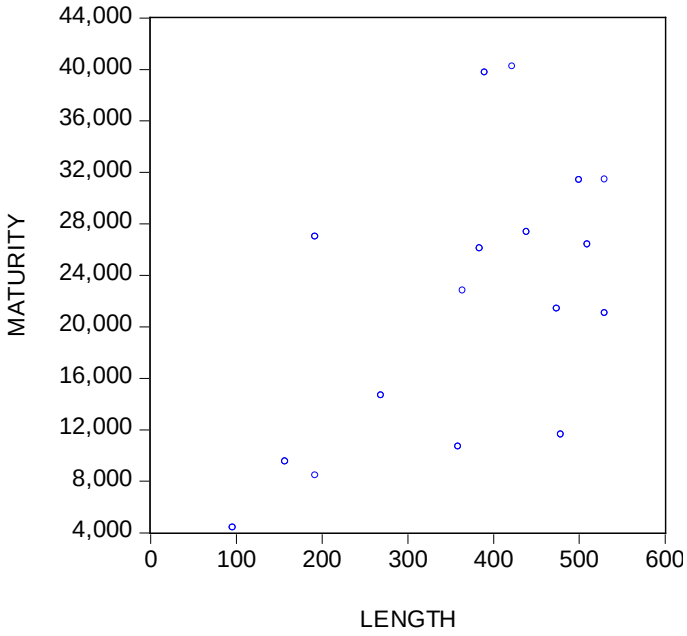

Figure 5: Older social media reach higher maturity levels, while more recent social media are less successful. Regression line has slope 43.5 with estimated standard error 16.4

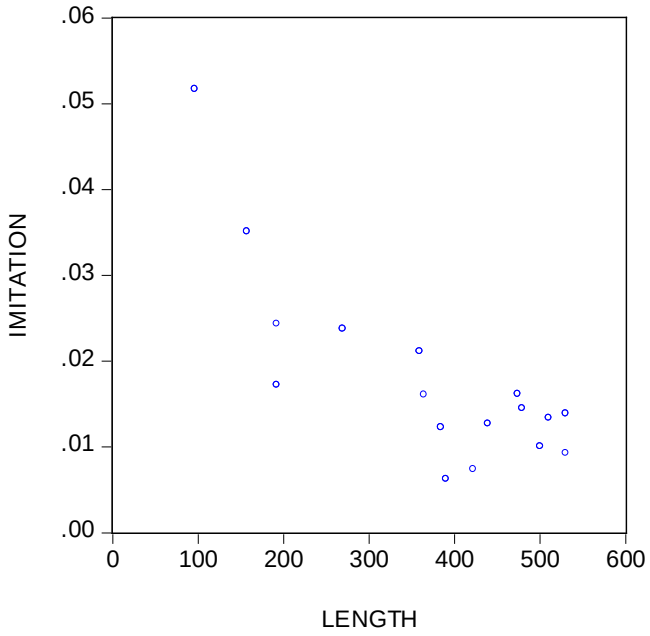

Figure 6: More recent social media have a much higher degree of imitation than older social have. Regression line of 1000*imitation has slope -0.064 with estimated standard error 0.013

References

Bass, F.M. (1969), A new-product growth model for consumer durables, *Management Science*, 15, 215-227

Boswijk, H.P. and P.H. Franses (2005), On the econometrics of the Bass diffusion model, *Journal of Business & Economics Statistics*, 23, 255-268.