Policy-oriented evaluation of the expansion of top level domain name space

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Abstract

This article attempts to provide a quantitative analysis in order to estimate the essentiality of the new generic top-level domains, which were newly introduced to the domain name system of the Internet according to the New gTLD Program of the Internet Corporation for Assigned Names and Numbers (ICANN), and to draw implications on Internet policy for both national governments and ICANN. The author finds that the effect of the registration fee on the domain name volume is significantly different between the generic and geographic gTLDs, and between the generic and internationalised gTLDs, thus concluding that the geographic and internationalised gTLDs have a higher degree of essentiality and that they cater to different demands of the domain name registrants. Based on the findings, the author draws two policy implications. First, the expansion of the top-level domain name space, which ICANN has implemented over years, is considered to serve some real-world user requirements. Second, considering the higher degree of essentiality, the geographic gTLDs, unlike other new gTLDs, may well fall under regulatory oversight in order to ensure stability and trust among the domain name registrants.

1. Background

The expansion of the top-level domain name space was one of the core mandates since the Internet Corporation of the Assigned Names and Numbers (ICANN) was founded in 1998, and was implemented in multiple phases over years. Before ICANN started to implement the New gTLD Program in 2013, there were only twenty-some gTLD's online. At the time of writing, a total of 1,186 new gTLD's (ngTLD's hereafter) have been added to the top-level domain name space.

One of ICANN's key responsibilities is to introduce and promote competition and consumer choice in the registration of domain names, while ensuring the security and stability of the domain name system (DNS). The expansion of the top-level domain name space was called for in line with this. The Corporation also commits itself to provide wider opportunity for the speakers of languages other than English and other

major languages through multilingualise, or 'internationalise' the strings that are used in domain name labels.

However, the benefit of the expansion of the domain name space, including the New gTLD Program, is, if not hypothetical, untested on fact-based studies, and the actual benefit is not clear compared to the risk and complexity that the expansion entails.

As new top-level domain names are added to the root, it is increasingly important to see whether ngTLD's actually respond to different aspects of the demand and necessity that the domain name users, or registrants have over the Internet domain name.

On the other, top-level domain names are not, or have not been, an issue of solely technical management. ccTLD's and, more recently, geographic ngTLD's came under governmental oversight in some jurisdictions. One such example in recent years is the introduction of domain name regulation in Japan. Government involvement may be legitimate in theory, but the Internet has development what it is today without excessive intervention by government. So, it needs to be examined and justified against the reality of the top-level domain names space. If it does not have sufficient justification, the existing policy may well be adjusted to reflect the behaviour of the domain name users.

The expansion of the top-level domain name space has been carefully discussed and planned based on the consensus building process respecting the relevant community at the local and Internet levels. It is, however, still an open question whether the expansion has provided benefits to the end users in real terms, without becoming an end in itself.

2. Objectives and methodology

2.1 Objectives of the study

The objective of this study is two-fold. First, the author attempts to characterise the behaviour of the domain name registrants depending on the ngTLD that they choose. The author conducts a statistical analysis over the recently introduced ngTLD's to see whether they form a coherent group, or they form a few group depending on their nature as a top-level domain name.

Second, based on the findings from the question above, the author tries to draw two policy implications. One is the evaluation of the policy by ICANN to expand the top-level domain name space. The other is to evaluate the domain name regulation implemented by the Ministry of Internal Affairs and Communication of Japan in January 2015.

2.2 Previous studies

The top-level domain name has been the subject of research from various points of view. Its technological development and operation are by definition a core issue concerning domain names. Intellectual property rights are one of the areas where domain names have been extensively discussed since the wide adoption of the Internet. The multilateral and 'multistakeholderistic' politics, and the institutional design of the governance structure of the Internet have also been a major concern for Internet policy practitioners and researchers alike.

Although the expansion of the top-level domain name space has been generally welcomed, it has raised concerns over confusion among users and increasing cost and complexity in intellectual property protection (Katz et al., 2010). Prahl and Null (2011) discusses the problem of the mechanism planned for the protection of intellectual properties.

However, the study of the top-level domain name can take a different approach. At the end of the day, the end users, or registrants use the domain name for their own purposes and objectives. Therefore, it may be necessary to see how domain name registrants reacted to the various policy moves by ICANN, although the studies in this aspect is not yet fully pursued except for the small amount of literature.

Kamimura and Mikami (2011), based on a statistical survey on ccTLD's, whose administration of the country-code top-level domain (ccTLD) is not fully in the governance mechanism of the rest of the Internet, found out, among others, that the dispersion of registration fees is larger in the low income group of ccTLD's than in the high income group, and claimed that ccTLD's should be provided at an affordable price level if their objective is to serve the local community.

Kamimura (2013) found out that the influence of the registratio fee over the registration volume is significantly higher in the gTLD than in the ccTLD and that the ccTLD has lower price elasticity to demand than gTLD, thus concluding the ccTLD has higher essentiality to the local community, which needs to be taken into consideration in policy development.

Although the expansion of the top-level domain name space has tended to be discussed from institutional and qualitative perspecitve, quantitative or fact-based analysis and evaluation are gradually attempted. ICANN is mandated to review and evaluate its policy implementation on right protection mechanism, trademark clearinghouse, security and stability, competition, trust and choice, and DNS abuse among others (ICANN, 2015). Evaluation on some of the issues here has already been conducted and the result has been published.

Rafert and Tucker (2015) are one of ICANN's self-evaluation attempts, and interim evaluation of the New gTLD Program in terms of competition promotion. Their comparison of ngTLD's and legacy gTLD's shows, among others, that ngTLD's may have higher value than legacy gTLD's. However, they do not focus on the effect that registration price may have over the registrant behaviour, i.e. the number of registration.

2.3 Methodology

The author conducts multivariate regression analysis to estimate the effect of the factors over the volume of the registrations for each newly introduced gTLDs.

In this study, the author views the use of domain name as the use of a domain name resolution service, whose value is to convert a human readable identifier (domain name) to a specific IP address, or vice versa. Therefore, the author regards domain names as a market goods, and attempts an analysis of the effect of the price on the usage volume.

2.3.1 Data collection

For each ngTLD's, the number of registrations, the registration fee, and the ngTLD type are collected for analysis.

The number of registrations is taken from nTLDStats[1], which publishes registration statistics by ngTLD and by registrar on a daily basis. The statistics are compiled from the registrars' reporting to ICANN.

The registration fee is calculated as a weighted mean of the fees posted on major registrars that publish a registration fee for a given TLD. In calculating the weighted mean, the registration fees are converted to the US dollar at the currency exchange rate as of 31 December, 2015.

Data for registration fee are taken from the 16 registrars (Table 1), which have more than one percent of the total share of ngTLD registrations. Although there are more than 240 registrars that deal with ngTLD registration, these 16 registrars account for three quarters of the total registrations. However, price data for internationalised TLD's are not sufficiently available from these 16 major registrars. Additionally, one registrar (101domain, Inc.) which is actively serving internationalised TLD's was added to complement the price data.

Table 1: Registrars for price data

Registrar ID	Registrar Name
48	eNom, Inc. (Rightside)
49	GMO Internet Inc.
69	Tucows Domains Inc. (OpenSRS / Hover)
83	1&1 Internet AG (United Internet AG)
303	PDR Ltd. d/b/a PublicDomainRegistry.com†
625	Name.com, Inc. (Rightside)
1011	101domain, Inc.
1068	NameCheap, Inc.
1331	eName Technology Co., Ltd.
1345	Key-Systems, LLC (KeyDrive Group)
1408	united-domains AG (United Internet AG)
1556	Chengdu West Dimension Digital Technology Co., Ltd.
1599	Alibaba Cloud Computing Ltd. d/b/a HiChina (www.net.cn)
1655	Xiamen Nawang Technology Co., Ltd
1659	Uniregistrar Corp (Uniregistry Corp.)

1 <http://www.ntldstats.com>

Registrar ID	Registrar Name
1723	Internet Domain Name System Beijing Engineering Research Center LLC (ZDNS)
1857	Alpnames Limited

Some ngTLD's are not listed on registrars for general registration even after delegation from ICANN. Some of them are just newly delegated and are not ready for general registration. Other ngTLD's are delegated and actively used, but not available on the registrars that the author visited. They may be taking registrations through intermediaries or wholesale registrars, so that the price details do not show up on retail registrars' website. Those ngTLD's whose price information is not available are excluded. Only ngTLD's that are available for ordinary Internet users are counted in this study.

The registration fee is the annual amount that the registrant pays to the registrar when they register a name under the ngTLD that they choose. It is, in other words, a retail price. In this study, the retail price, rather than the wholesale price that is payable to the registry by the registrar, is collected, because the retail price may influence the behaviour of the registrant more directly than the wholesale price.

The TLD type may take 'geographic', 'community' and/or 'internationalised'. 'Geographic' and 'community' are as defined in the ngTLD application to ICANN, and 'internationalised' means that the ngTLD is an internationalised TLD. These types are non-exclusive. For example, an ngTLD may be of 'geographic' and 'internationalised' type' at the same time.

All the data were taken in January and February 2016.

2.3.2 Analysis

As in the previous studies, multivariate regression analysis is applied. All metric variables are transformed to the logarithm to base 10 ($\log_{10}$) in the model. And the ngTLD type is represented as a dummy variable in the model.

The analysis is conducted in two steps. First, all ngTLD model is examined where the

number of registrations is a dependent variable, and the weighted mean of the registration fees (fees payable by the registrant to register a domain name) and the application type of the ngTLD (geographic, internationalised, and generic) are independent variables, to see the effect of the registration fee on the registration volume, and how the effect varies by application type.

For geographic ngTLDs, the effect of population and per capita income of the city or relevant locality are also considered for more detailed analysis. Population data are taken from City Population[2]. Although some cities, such as London and Tokyo, form a wider geographic area (Greater London Authority or Tokyo Metropolitan Region) that includes surrounding suburbs, the population of the smaller nominal city area is taken.

Data for per capita income are taken from the International Monetary Fund (estimate figures for 2015). Due to the methodological limitations, national per capita income is regarded as city-wide per capita income in the analysis.

2.3.3 Data overview

In all, data for 418 ngTLD's are collected. Of the total, 347 are intended for 'Generic' use or purposes, 22 are 'Internaionalised' ngTLD's, meaning that the ngTLD's are composed of an internationalised string. 40 are 'Geographic' ngTLD's and 18 are 'Community' ngTLD's. One ngTLD's may take two or more types. One ngTLD belongs to both 'Internationalised' and 'Geographic'. Ten ngTLD's belong to 'Geographic' and 'Community'. None of the 418 belongs to both 'Internationalised' and 'Community'. The data are summarised in Table 2

Table 2: Overview of the data

	Min	Mean	Median	Max	SD
No. of registrations	169	26,496	5,380	1,796,131	114,928.1
Registration fee	$0.75	$42.65	$22.49	$1,836.14	$115.35
Population ('000)	253	5,001	3,092	17,638	4,737
Per capita income	$6,477	$41,890	$47,700	$64,260	$15,669
Type of ngTLD	Generic: 347, Internationalised: 22, Geographic: 40, Community : 18				

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2 Thomas Brinkhoff, City Population <http:www.citypopulation.de>

3. Results

3.1 All ngTLD model

First of all, regression analysis is applied on a total of 418 ngTLDs to see the effect of the registration fee and ngTLD type on the registration volume. A regression model including all ngTLD's is considered, where the number of registrations is the dependent variable, and the registration fee, three dummies that represent the application type, i.e. Geographic, Internationalised, and Community, and the interaction between registration fee and the application type, are taken as independent variables.

It turns out that the effect of the Community dummy is not significant even at 5% level, so that only the Geographic and Internationalised dummies remain in the model. The result is as follows. (网址 is excluded from the analysis as an outlier.)

Table 3: Estimates in the All ngTLD model

	Estimates
Intercept	4.92408 ***
Registration fee	-0.86046 ***
Geographic	-1.44947 ***
Internationalised	-1.06999 ***
Registration fee x Geographic	1.16849 ***
Registration fee x Internationalised	0.67315 ***
Adjusted R^2	0.3657
F-statistics	48.97 (5, 411) ***

***: <0.1%

The model (Table 3) is significant at 0.1% level and the adjusted R^2 is 0.3657. The coefficients for the Registration fee is -0.860, for Geographic (dummy), -1.449, for Internationalised (dummy), -1.069, for the interaction between the Registration fee and Geographic, 1.168, and for the interaction between the Registration fee and the Internationalised, 0.673. All coefficients are significant at 0.1% level.

In Figure 1, ngTLD's are plotted by Registration fee and Number of registration. The solid line that runs downwards from the top left corner shows the price sensitivity of the generic ngTLD's. The dashed line that goes upwards is the slope of the geographic ngTLD's. And the dotted line that goes in-between shows the price sensitivity of the internationalised ngTLD's.
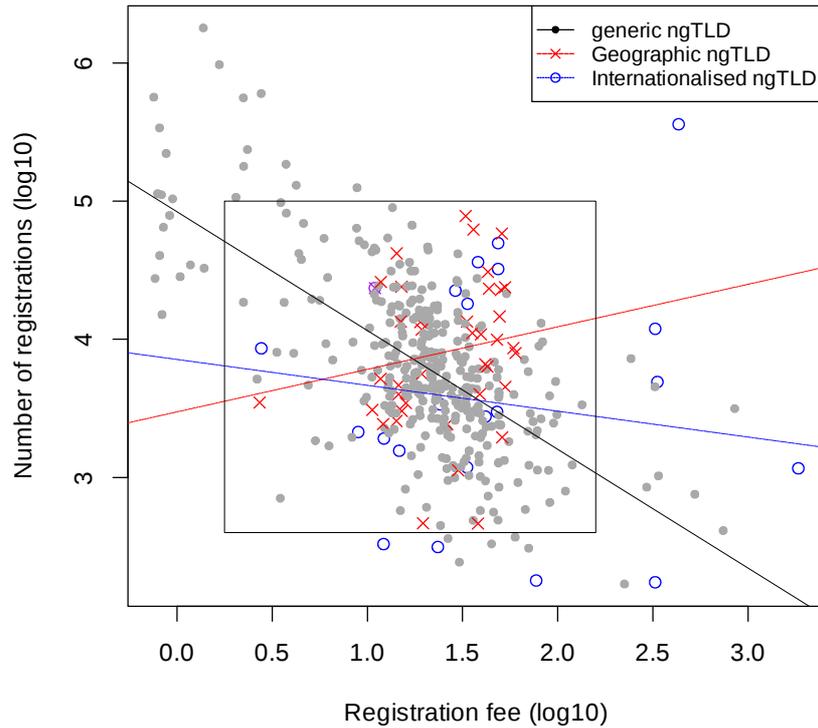

Figure 1: Regression results for the All ngTLD model
(Area in rectangle enlarged below)

In general, when the registration fee (log10) goes up by one unit, the number of registration (log10) changes by -0.860. It means that when the true value of the registration fee rises by 10 times, the true number of domain names decreases to 13%.

For geographic and internationalised ngTLD's, an increase in the registration fee has significantly different effect compared to generic ngTLD's. The effect of the increase of the registration fee for internationalised ngTLD's is weakened. The number of registrations declines, but not to the extent of ngTLD's. An increase in the registration fee (log10) by one unit decreases the number of registrations (log10) by 0.187 (a change by -0.187). It means that a ten-time increase of the true registration fee translates into a decrease of the number of registrations to 64.9%.

For geographic ngTLD's, on the contrary, an increase in the registration fee does not pushes down the number of registrations. A one-unit change in the registration fee accounts for a change of the number of registration by 0.308, increasing the number of domain names to 203%.

In summary, the number of registrations of generic and internationalised ngTLDs decreases as the registration fee increases, although the rate of decline of the internationalised ngTLDs is significantly smaller than that of generic ngTLDs. On the contrary, the registration volume for geographic ngTLDs tends to increase even as the registration fee goes up. The number of registration of generic ngTLD's is more prone to price change, or have high price elasticity than the other two ngTLD groups.

It is considered that domain name registrants choose geographic and internationalised ngTLD's because the domains are more essential to their presence on the Internet and the demand is not elastic to the price.

3.2 Discussion on Internationalised ngTLD

Internetionalised ngTLD's are composed of Unicode characters, including alphanumeric characters that are traditionally available in domain name labels as well as characters in Han (Chinese), Cyrillic, Thai, Arabic, Japanese and other scripts (internationalised characters hereafter). Internationalised characters are already in use for Internationalised ccTLD's, e.g. рф (Russia), 新加坡 (Singapore), ไทย (Thailand), 한국 (Korea). The New gTLD Program expands its scope to gTLD's.

As the time of this study, a total of 22 internationalised ngTLDs are publicly available (Table 4), meaning that the IDN gTLD's are available for general registration at one or more registrars. Of these 22, 14 are Chinese (Simplified), four are Cyrillic, three are Arabic, and one is Japanese (Hiragana). Nearly two-thirds of the internationalised ngTLD's serve Chinese-speaking Internet community at the moment.

The strings for the internationalised ngTLD's are plotted in Figure 2. As is seen in the figure, Chinese ngTLD's do not only outnumber other ngTLD's in count, but more than half of them also host more domain name registrations than the estimated level.

Not all Chinese ngTLDs have more registrations than the average, but most of the ngTLDs that have more-than-the-average registrations are Chinese. Cyrillic ngTLD's, except for the .москва domain, only have registrations on average level or below.

Considering the fact that .москва is a geographic as well as internationalised ngTLD, it can be said that Cyrillic ngTLD's are not yet accepted by the speech community in general. Arabic ngTLD's are also slow to take up. One of the three Arabic domains is drawn on the regression slope, but the other two are far below the slope, which means they are used less than the estimation. The only one Japanese ngTLD, .みんな, entertains few registrations. Japanese is not a major language in the ngTLD space.

Figure 2: Internationalised ngTLDs plotted in the All ngTLD model

In summary, internationalised ngTLD's are relatively popular in Chinese, whereas those in other languages or scripts are not used extensively or at least yet to come. It is not clear why Chinese ngTLD's are adopted in a larger scale compared to others. It may be because its speech community prefers to use the Internet in their own language or because the take up of the Chinese ngTLD's was triggered by some promotion campaigns of registrars.

Some Chinese ngTLD's are actually highly priced. It costs more than US$300 to register a name under Chinese ngTLD's, such as 网址, 商城, 商标, 集团, and 网店. This pricing does not seem to be affordable for ordinary Internet users. But these ngTLD's carry meanings, such as "website", "shopping mall", "trademark", "group", and "net shop", which are more familiar to corporate registrants rather than to individual users. They actually have more registrations than expected in the model, except for the domain 网店. These ngTLD's apparently serve better to their targeted audience.

Most of the internationalised ngTLD's that are available to date stand for 'website', 'market' or other generic words. They do not carry culturally or linguistically marked meanings. If ngTLD's only carry simple, generic meanings in the vernacular scripts, they do not yield more value than their alphanumeric counterparts. Currently, IDN ngTLD's do not have high cultural or linguistic values compared to the alpha-numeric top-level domains.

This is considered to be another reason why internationalised ngTLD's are positioned between the generic and geographic ngTLD's in terms of the sensitivity to the registration fee. Internationalised ngTLD's do have higher added-value than generic ngTLD's, but they do not have as much added-value as Geographic ngTLD's.

Table 4: List of internationalised ngTLD's

ngTLD	A-Label[†]	Script	Notes
شبكة	xn--ngbc5azd	Arabic	/shabaka/ "site"
中信	xn--fiq64b	Han	/zhōngxìn/ Name of a corporate group
онлайн	xn--80asehdb	Cyrillic	/onlain/ "online"
世界	xn--rhqv96g	Han	/shìjiè/ "world"
сайт	xn--80aswg	Cyrillic	/sait/ "site"
网址	xn--ses554g	Han	/wǎngzhǐ/ "website"
网店	xn--hxt814e	Han	/wǎngdiàn/ "net shop"
集团	xn--3bst00m	Han	/jítuán/ "group"
みんな	xn--q9jyb4c	Japanese	/minna/ "everybody"
中文网	xn--fiq228c5hs	Han	/zhōngwénwǎng/ "Chinese web"
商标	xn--czr694b	Han	/shāngbiāo/ "trademark"
网络	xn--io0a7i	Han	/wǎngluò/ "network"

ngTLD	A-Label[†]	Script	Notes
商城	xn--czru2d	Han	/shāngchéng/ "shopping mall"
我爱你	xn--6qq986b3xl	Han	/wǒàinǐ/ "I love you"
москва	xn--80adxhks	Cyrillic	/moskva/ Moscow
بازار	xn--mgbab2bd	Arabic	/bazaar/ "market"
موقع	xn--4gbrim	Arabic	/mawqe/ "website"
移动	xn--6frz82g	Han	/yídòng/ "mobile"
在线	xn--3ds443g	Han	/zàixiàn/ "online"
机构	xn--nqv7f	Han	/jīgòu/ "organisation"
公司	xn--55qx5d	Han	/gōngsī/ "company"
орг	xn--c1avg	Cyrillic	Transliteration of .ORG

[†] A-Label is a domain name label converted in punycode (alphanumeric transliteration).

3.3 Geographic ngTLD

3.3.1 Geographic ngTLD model

As discussed in 3.1, the Geographic ngTLD's shows a significant difference in the effect of the registration fee compared to generic ngTLD's. It apparently contradicts the natural course of thinking because an increase in price may end up in a decrease in demand.

The registration fee for the geographic ngTLD's examined in this study ranges from $2.71 (.SAALAND) to $59.99 (.SYDNEY). Each geographic region has different socioeconomic conditions, which may well affect the use of the domain name. If a city has a large population, the corresponding ngTLD has a potential to have a large number of registrations. If the city has a strong economic basis, the citizens or businesses may find it more affordable to obtain a domain name, thus pushing up the total number of domain name registrations.

To get a closer look at the user behaviour over the geographic ngTLD's, a separate regression model in cosidered, including only Geographic ngTLD's. The effect of the per capita income and population of the city/region, and their interaction are added in this model to see what impact each of this factors may have over the registrants' behaviour.

The obtained model (Table 5) is significant at 5% level, with the adjusted R^2 being 0.214. In the model, the Registration fee, by itself, has a negative coefficient, meaning that a rise in the registration fee may decrease the number of registrations, but not at significant level. The effect of per capita income is significant in itself (1.606**), but the effect is more evident when the interaction between per capita income is taken into account (5.137*). As a result, the number of registrations goes us along with the increase in per capita income. Population tends to push up registrations but, again, not at significant level.

Table 5: Estimates in the Geographic ngTLD model

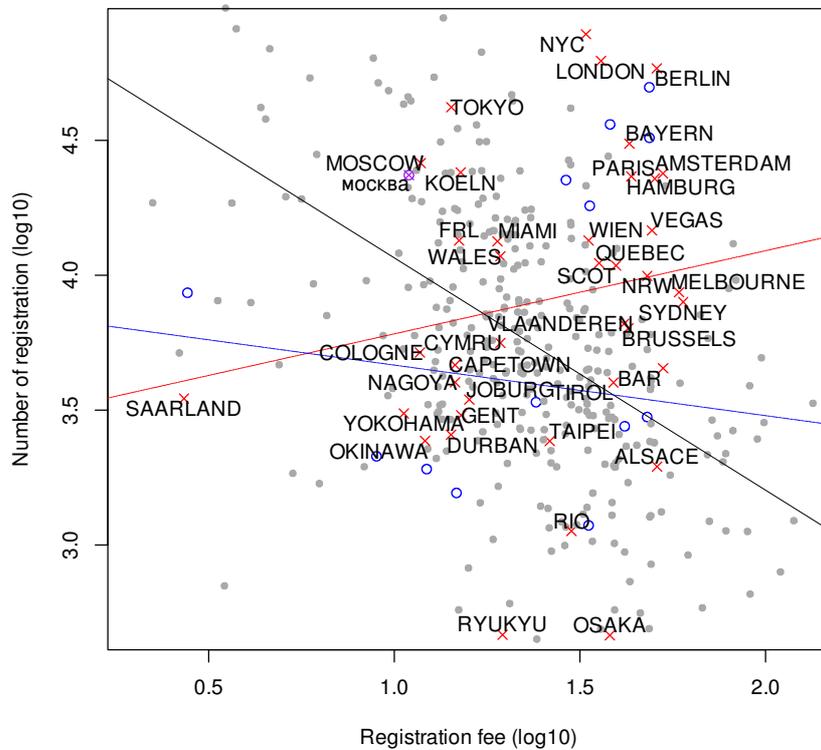|	Estimates
Intercept	-0.14348
Registration fee	-0.49366
Per capita income	1.60603 **
Population	0.32496 +
Registration fee x per capita income	5.13784 *
Adjusted R^2	0.2144
F-statistics	3.593 (4,34) *

+: 10%, *: 5%, **: 1%

Figure 3: Enlarged Figure 1 with geographic ngTLD plotted

As shown in Table 5, the effect of interaction between the Registration fee and Per capita income turns out to be significant. Then, simple main effect is tested, dividing the ngTLD's into two groups based on the level of per capita income.

In both high income and low income groups, the registration fee has a significant effect over the number of registrations, but it turns out that the effect of the registration fee is reversed depending on per capita income. In the low income groups, an increase in the registration fee pushes down the number of registrations (β=-1.904, $p<0.05$), whereas in the high income groups the number of registration grows irrespective of the registration fee level (β=0.917, $p<0.05$).

This result shows that in the low per capita income group, the registration volume declines as the registration fee rises, whereas the registration volume increases as the registration fee goes up in the high income group. In the low income group, the demand of ngTLD's is more elastic to the price, whereas the demand is quite stable or even more intensified. Although the result is not consistent across all the Geographic ngTLD's, it can be said that at least a part of the Geographic ngTLD's show consistent results with the findings from the analysis of generic ngTLD's.

If you look at the difference between the estimates and the observations, BERLIN, LONDON, NYC, KOELN and TOKYO have more registrations than the estimates in the model, whereas OSAKA, RYUKYU, ALSACE, SUDNEY, and MELBOURNE have fewer registrations than estimated in the model. In the former group, BERLIN, LONDON and NYC are known to have been campaigning to ICANN and the community for top-level domain names for cities or other subnational geographic units well before the launch of the New gTLD Program. It may be said that their long-running effort has attracted more public attention to their domains, which resulted in number. Although TOKYO is a late comer in the campaigns to ICANN and the community, it is known to employed a Japanese female idol group, AKB48, for publicity, which undoubtedly attracted public attention ahead of other Japanese geographic ngTLD's, such as OSAKA and OKINAWA.

The use of geographic ngTLD's is not significantly affected by population. It is also pointed out that Geographic ngTLD's are used for the marketing to or communication with the rest of the world, rather than internal residents of the geographic area.

3.3.2 Traditional names vs. international names

Some cities or regions have two geographic ngTLD's, one in a traditional name and another in an internationally known name. In the data of this study, four pairs of them are found.

One name in the pair tends to be more favoured over the other although each pair is administered by the same Registrar supposedly according to the same technical and promotional conditions.

Both Okinawa and Ryukyu are names given to more or less the same region that is located in the southwest part of the Japanese archipelago. Okinawa is the commonly known name today for the region. Ryukyu is the name in use before the 19th century. It is still used today only with some specific historical connotations. The OKINAWA domain has more names registered than RYUKYU. Wales, part of the Island of Great Britain, has two geographic ngTLD's. One is WALES, and the other is CYMRU. The former entertains approximately twice as many domain names as the latter. In both of these cases, the ngTLD in the international name is more favoured over that in the traditional name.

In the COLOGNE/KOELN pair, however, the situation is somewhat different. The traditional or vernacular name, KOELN, has four times the number of domain name registrations than the international name, COLOGNE.

Each of the pairs, except for moscow/москва, has one ngTLD with a larger number of domain names and one with a smaller number of them. The author cannot draw a definitive conclusion due to the limitation of the sample, but it may be likely that names that are more familiar to the rest of the world are favoured because traditional names are less likely to be understood by the non-resident users.

This is in line with the earlier analysis that geographic ngTLD's, or possibly ngTLD in general, serve wider Internet community rather than smaller local community. Although one of the rationale behind the expansion of the top-level domain name space is to cater to the various linguistic and cultural needs of local users, ngTLD's are likely to be chosen in order to communicate with the rest of the Internet, and ngTLD's in traditional names should be driven by strong intra-community motivation if it is necessary.

Table 6: Number of registrations by traditional and international names

City/Region	Trad. name	Domains	Intl. name	Domains
Wales	cymru	5607	wales	11744
Okinawa	ryukyu	465	okinawa	2431
Koeln	koeln	24026	cologne	5169
Moscow	москва	23476	moscow	25997

3.4 Implications on domain name policy at government level

The expansion of the top-level domain name space is expected to accommodate the necessity or essentiality. Here, it will be discussed what implications the above findings lead to in terms of domain name policy development.

The first question is whether the expansion of the top-level domain name space benefits the end user. It can be answered from multiple points of view. Here, in this paper, the author discusses the answer in terms of the diversity of the demand by Internet users.

A domain name can be used for various purposes. Some may use it for branding a commercial website, others may use it for posting personal blog articles, and still others may use it only for machine readable identifications, e.g. XML namespace, without telling the human user that the domain names are in place. So, the level of necessity or essentiality that registrants expect of the domain name of their choice varies depending on their purpose.

As this study shows, generic, internationalised and geographic ngTLD's are different from each other in terms of the sensitivity to the registration fee. The author interprets this as one of the clues that the varying degrees of necessity or essentiality are accommodated in the top-level domain name space. In this sense, the objective of the expansion of the top-level domain name space is achieved.

The second question is whether the doman name regulation is justified considering the user behaviour over ngTLD registration. The author takes the recent regulation in Japan as a case to discuss this question.

The regulation was introduced by the revision of the Telecommunications Business Act in 2015. The Act mandates an entity that offers domain name resolution service in Japan to comply with technical, neutrality, and accounting standards specified by the Minister for Internal Affairs and Communications.

Even before the Act, domain name registrars operated under contract-based or self-disciplined standards. These standards became legal requirements by the Act. The revision was brought about after a lengthy public consultation over the operating mode of the Japan Registry Service (JPRS), a privately owned company, which runs the JP domain.

In theory, the new regulation is aimed at a domain name resolution service that has significant impact in Internet communication in Japan, but in practice, it is targeted at the JP domain, and geographic ngTLD's that are associated to Japanese geographic entities, such as TOKYO, OSAKA and OKINAWA.

It is somewhat awkward to introduce a new regulation in the area of telecommunication and the Internet, where incoming policy tends to be developed towards deliberalisation and openness. If the regulation is really in nead, it is even more necessary to show that the regulation is not arbitrary, but that it has reasonable justification considering the nature of the top-level domain name. As previous studies show (e.g. Kamimura, 2013), ccTLD's are more stable in demand and less sensitive to price than gTLD's, so that imposing some regulation on ccTLD's may be justified, but not geographic ngTLD's yet.

As this study shows, geographic ngTLD's have stable demand and low price elasticity, compared to generic ngTLD's. The users will register domain names in geographic ngTLD's even if the price is high whereas they can do without ngTLD's, which they find expensive.

In addition, geographic ngTLD's have different governance requirements from generic or internationalised ngTLD's. The application of geographic ngTLD's was sponsored by relevant authorities to ensure the applicant fairly represent the local community. In some geographic communities, the applicant was chosen by a competitive process so that the interests of the local community are better respected.

Considering that geographic ngTLD's are different from generic, and internationalised ngTLD's with regards to essentiality and governance, the domain name regulation that was introduced in Japan is justified at least to some extent.

4. Conclusion

The author concludes that these differences reflect that geographic and internationalised ngTLD's have a higher degree of essentiality than generic ngTLD's and that they serve different demands of the domain name registrants.

In addition, analysis of strings that compose internationalised and geographic ngTLD's is provided. Some cities and localities are represented in both traditional and widely known name (e.g. cymru and wales). The result indicates that geographic ngTLD's, if it is represented in the traditional name, are not utilised to the same extent as their common name counterpart. The same tendency is also observed with internationalised ngTLD's, except for those in Chinese characters. Extensive use of international ngTLD's is not necessarily made, either.

These results may indicate that ngTLD's, whether internationalised or geographic, are preferred in widely known form to those in traditional form which may be unintelligible to the rest of the Internet because of the language or script. One possible exception is internationalised Chinese ngTLD's, where traditional names presumably have a sufficiently large user base and are preferred to widely known names.

Based on the findings, the author draws two policy implications. First, the expansion of the top level domain name space, which ICANN has implemented over years, is not only considered to be successful from the perspective of registration volume, but also from the perspective of diversity in domain name requirements. In response to the requirement from the Internet community, ICANN has introduced new top level domains in several rounds. Although these additions were welcome from the perspective of increased user choice and competition in the domain name market, these streams of argument have not been tested against user acceptance yet. According to the result of the analysis in this study, the author concludes that newly added gTLD's do reflect the diversity of domain name requirements in the Internet community with varying degrees of essentiality.

Second, considering the high degree of essentiality, the geographic gTLD's, unlike other ngTLD's, may well fall under regulatory oversight in order to ensure technical stability and consumer trust in some policy context, for example, in Japan. Domain name registration did not fall under the governmental oversight before 2015 in Japan. However, under the Telecommunications Business Act that was revised in 2015, new legal obligations are imposed on domain name registrars that serve the JP domain and other ngTLD's that are related to Japanese geographic names. They are now legally responsible to ensure stable and reliable operation of the top level domain, and to ensure transparent accounting and governance. The revision came as an outcome after a lengthy debate over the governance of .JP, which is expected to serve the local Internet community at large while being run by a privately owned company, the JPRS. If domain name registrants have different expectation for geographic, internationlised and other ngTLD's respectively, and geographic ngTLD's have higher degree of essentiality, the new legal obligation on Japanese domain name registrars is justified considering the behaviour of the domain name registrants, at least to some extent.

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