THE ".IT" DOMAIN MARKET: DETERMINANTS OF DIGITAL DIVIDE IN ITALY

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ABSTRACT

The study reported in this paper is addressed to the identification of factors contributing to the differences about Internet use (digital divide) in Italy in recent years. In Italy, the registration of a new Internet domain name is usually made through a service company (Registrar) accredited by the National Registry, where all data related to such registration are managed. In order to analyze the diffusion of the Internet in Italy, the number of Registrars and the number of registered domains were used as indicators.

To define the factors that determine the digital divide the regression multiple model was utilized, based on the stepwise method. The dependent variable taken into consideration was the penetration rate at the regional level and the independent variables were regional economic, cultural, demographic and technological factors.

This research showed that few regions are specialized in Information and Communication Technology (ICT) services provision, compared to the national average. Above all the regions with a low unemployment rate and with high economic values, such as added value per employee and high per capita income, are more inclined to use the network. Furthermore, the level of education resulted a decisive factor: as a matter of fact, regions with a high number of graduates, specialized in ICT fields, are more inclined to utilize the Internet technology than those that register a number of ICT graduates below the average.

KEYWORDS

Diffusion of the Internet, Digital Divide, Domain names, Registrars

1. INTRODUCTION

The Web has undeniably entered our everyday life forcefully, ceasing to be an instrument used by a limited circle of academics to become a new and versatile example of mass media. As a matter of fact, as stated by Greenstein & Price (2004), the Internet "has relative advantages along many dimensions". It provides written communication that is much faster than ordinary postal mail, it allows for purchases on line without a direct interaction with the shop, and increases the speed of information gathering. The Internet is also easy to use (for example from a PC of a friend or at work), easy to observe, and compatible with consumers' needs (information gathering, communication speed). Furthermore, its complexity is decreasing considerably. All these attributes contributed to an increase in its diffusion. According to the above authors there are five attributes which, on average, are considered as the most influential for speed of adoption of a technology across different types of users: relative advantage, compatibility, complexity, trialability and observability. Any increase in the relative advantage over the previous technology, the compatibility of the new technology with the needs of potential adopters, the ability of adopters to experiment with the new technology and the ability of the users to observe the new technology, are all attributes that will speed up the diffusion process. Although Internet has become a worldwide protagonist of our days, it is not geographically uniform among countries, as well as within a country. For example Greenstein and Price (2004) reported that people living in rural areas might find greater relative advantages from the use of the Internet than people living in urban areas. Furthermore, according to Strover (2001), low Internet adoption is caused not only by factors such as lower education and income levels, but also by socio-economic factors and by low levels of technological knowledge. Based on the above consideration, this work wanted to verify if in Italy it is possible to sub-divide Internet users on the basis of the categories proposed by Rogers (1995) for the generic diffusion theory of a technology: innovators, early adopters, early majority, late majority, and laggards. For this purpose, the

Internet diffusion in Italy was analyzed by using as indicator the number of companies (Registrars) that offer, as a service, the registration of domain names under the country code Top Level Domain (ccTLD) ".it". Furthermore, in this paper the factors contributing to the differences in Internet use (digital divide) in Italy at a regional level were defined by verifying the effects on the adoption of some local socio-economic hypotheses.

2. METHODS

In order to analyze Internet diffusion in Italy, the number of Registrars registered up until 31 December 2005 were used as an indicator. The data were extracted from the databases managed by the National Registry, at the Institute of Informatics and Telematics of the National Research Council in Pisa (IIT-CNR). The database managed by IIT-CNR until the above date, counted 2693 Registrars, 2552 of which were Italian and 141 foreign. The choice of using Registrars as indicators instead of, for example, the number of domain names, which is one of the indicators most used in the literature (Zook, 2000; Bauer et al., 2002) together with the hostcount (see studies published by Internet Software Consortium or by RIPE-NCC (Réseaux IP Européens - Network Coordination Centre) derived from the fact that the number of Registrars is an indicator that appears to be more effective in order to identify the real extent of the Internet phenomenon in Italy. In fact, Registrars, in addition to registrating domain names, can supply other services related to Information and Communication Technology (ICT), such as Internet connectivity, selling of hardware and software products, electronic mail services, website design, and so on.

This research intended to achieve two main goals. The first, was to analyze the extent of the Internet phenomenon in Italy, through which it is possible to compare the Italian situation with the international one and, therefore, to identify the situation of Italy within the international ranking of Internet use. The grouping of data at regional level allows comparison of the penetration and specialization rate of registrars in single geographical areas and measures the possible technological gap (the so-called digital divide). Moreover, it defines the factors that cause the digital divide in Italy. The second purpose of this research was to identify in which geographical areas, among the Registrars, there are the highest number of domain name registrations. This establishes the specialization rate of Registrars in the domain name registration service supply and determines if in Italy there exists a competitive market in the domain name registration field. It is necessary to highlight that in this research only data concerning the number of registered domain names were examined. Some Registrars, as matter of fact, focus their business on other types of services such as the xDSL access supply for retail customers, hardware and software sales, VoIP (Voice over IP) services or e-commerce and so on. The indicators used to identify in detail the existence of the digital divide in Italy at the regional level, were the penetration rate (PR), the specialization rate of a geographical area in ICT services supply (SR1) and the specialization rate of Registrars in domain name registration (SR2). These entries allowed to analyze in detail the existence of digital divide in Italy at local level and also in macro-areas (North, Center, South). As penetration rate, the ratio between the number of Registrars and the number of service companies existing in Italian national territory was used:

PR = penetration rate = (number of registrars / number of service companies) x 100.

As specialization rate of a geographical area (SR1) in ICT services supply, the ratio between the PR at regional level and the PR at national level was used. The specialization rate, widely used in the literature, can vary from values less than one to values greater than one. An index value greater than one indicates a high specialization in ICT services supply in a particular geographical area (macro-area and region) compared to the national average, while an index value less than one indicates a low specialization. In order to identify maintainer specialization in the registration of domain names registered under the ccTLD .it, the specialization rate (SR2) was calculated in the following way:

SR2 = number of domain names registered by Registrars in a geographical area/number of Registrars in that geographical area

total number of domain names registered by all Italian Registrars/number of all Italian Registrars

Also in this case, an index value greater than one indicates a high specialization in domain name registration compared to the national average, whereas an index value less than one indicates a low specialization.

3. RESULTS AND DISCUSSION

The analysis based on the proposed methods showed that in Italy, in the analysed period, only some regions registered the highest penetration rates. In particular northern and central regions registered penetration rates greater than one (see Table 1).

Table 1. Internet distribution: the first ten Regions are ordered on the basis of the number of Registrars per 100 service firms (PR).

Ranking on the basis of registered penetration rate	Region	Area	Number of Registrars	Percentage of Registrars on the national total	Penetration Rate (PR)	Specialization Rate (SR1)
1	Lombardy	North	707	27.70%	20.34	1.40
2	Trentino Alto Adige	North	65	2.55%	16.86	1.16
3	Piedmont	North	231	9.05%	16.45	1.13
4	Umbria	Centre	43	1.68%	16.16	1.11
5	Tuscany	Centre	207	8.11%	16.01	1.10
6	Friuli Venezia Giulia	North	57	2.23%	14.92	1.03
7	Emilia Romagna	North	228	8.93%	14.21	0.98
8	Latium	Centre	253	9.91%	14.17	0,97
9	Veneto	North	217	8.50%	14.09	0.97
10	Campania	South	142	5.56%	12.21	0.84
	Italy		2552	100.00%	14.55	1.00

Southern regions, except for Campania, resulted all below the tenth position. In order to reach the second purpose of this research, the number of domain names registered by Registrars under the ccTLD ".it" was taken into account as indicator. However, also taking into consideration such indicator, the digital divide resulted to be significant. Only some regions of the North and of the South registered, on average, many domain names; while there is scarce propensity by the South, except for Sardinia, which proved to be the first region that registered, on average, the highest number of domain names (see Table 2).

Table 2. Distribution of domains in the ccTLD "it" registered: the first ten Regions are ordered on the basis of the average of registered domains per Registrar.

Ranking on the basis of the average domains registered	Region	Area	Number of Registrars	Percentage of domains registered by Registrars	Specialization rate registered domains (SR2)	Mean	Median	Range
1	Sardinia	South	29	7.79%	6.85	2777.34	78	39747
2	Tuscany	Centre	207	36.75%	4.53	1836.86	77	210255
3	Basilicata	South	9	0.51%	1.45	588.44	125	4396
4	Latium	Centre	253	13.84%	1.40	566.06	52	23939
5	Abruzzo	South	42	1.59%	0.97	391.86	83	10204
6	Trentino Alto Adige	North	65	2.09%	0.82	332.42	146	2395
7	Emilia-Romagna	North	228	6.33%	0.71	287.10	66	11599
8	Lombardy	North	707	15.75%	0.57	230.42	52	14313
9	Marches	Centre	58	1.23%	0.54	220.07	107	1238
10	Liguria	North	63	1.30%	0.53	214.02	77	2676
	Italy		2552	100%	1.00	405.37	63	210255

In order to identify the degree of concentration of the number of domain names registered by Italian Registrars in the different regions, two concentration indexes were used as indicators: the Herfindahl-Hirschman index (HHI) (Hirschman, 1964) and the Gini concentration index (Gini, 1912). The HHI index, widely used in literature, measures the degree of competition in the market. Considering an industry with N firms it is possible to measure the market share of each firm, HHI is calculated by adding the square of the market shares of each firm as:

$$HHI = \sum_{i=1}^{N} S_i^2$$

where S_i are the market share of each firm measured in percentage terms. For example, in the case of a market formed by four firms with shares respectively of 30%, 30%, 20%, 20%, HHI is equal to 2600 (30^2 + 30^2 + 20^2 + 20^2). The index is structured in a way that it increases both when the number of firms in the industry decreases and when the gap between firm size widens. An HHI index lower than 1000 indicates a market that is close to a competitive context. The markets in which HHI ranges from 1000 to 1800 are usually considered moderately concentrated. If HHI is greater than 1800, the degree of monopoly power becomes more significant. The HHI index calculated for Registrars at national level, resulted in Italy 542.75, showing that there are Registrars that are similar in size (in terms of registered domain names). Therefore it is not possible to talk about monopoly, and moreover the number of firms at national level proves to be high (2,552 Registrars). The Gini concentration index, unlike HHI, is a standard index, which ranges from 0 to 1. The Gini index is equal to 1 in case of maximum concentration (this happens when, for example, considering income distribution in a country, only one individual earns the entire amount of income), while it is 0 in a situation of even distribution (all individuals earn the same level of national income). Given its feature, that index is widely used in statistics literature because it renders better the concentration measurement in concrete situations and it is specially suitable for comparing the degree of concentration among heterogeneous situations. The Gini index at national level was calculated on the basis of the number of registered domain names, and it resulted 0.87, indicating that it is not possible to state that, in Italy, only one Registrar registers all the domain names under the ccTLD ".it". However, the value 0.87 is justified by the fact that only ten registrars out of 2,552 register 46.30% of domain names. The analysis of concentration resulted more clear when, in particular, the three macro-areas North, Center and South were analyzed. In fact, in the Center both the Gini and the HHI concentration indexes resulted high (0.93 and 1,838.44, respectively) and quite significant in depicting a situation of monopoly in the market of domain name registration. A Gini index of 0.93 indicated that only few Registrars register the total amount of domain names under the ccTLD .it. As a matter of fact, analyzing the data at an individual level, in the Center, only two Registrars out of 561 register more than half the domain names, 55.10% out of the total amount of domain names. This local result can be proven also by observing the HHI index that measures competition in a market of reference. The HHI greater than 1,800 in the Center means that, as mentioned above, in the Center the degree of monopoly power is relevant. The North, on the contrary, is the region in which there is more competition compared to the other macro-areas and, as resulted, the two concentration indexes are lower than in the Center and in the South: the Gini is 0.78 and HHI is 103.51. The data observed at an individual level, show that the first two registrars of the North register only 7.8% of domain names under the ccTLD .it, while in the Centre the two first registrars register more than 50% of domain names (see Table 3). In conclusion, the Center resulted less competitive in comparison with the North and the South.

Table 3 Analysis of concentration of domain names ".it" registered by Registrars.

Macro-Area	Gini Index	Herfindahl-Hirschman Index	Standard deviation	N	Mean	Median	Sum	% on the National total	Range
North	0.78	103.51	830.46	1575	212.28	59	334350	32.32%	14313
Centre	0.93	1838.44	9815.81	561	971.25	67	544874	52.67%	210255
South	0.83	940.84	2305.12	416	373.25	76	155275	15.01%	39747
Italy	0.87	542.75	4750.34	2552	405.37	63	1034499	100.00%	210255

3.1 Factors that Cause the Digital Divide

To define the factors that cause the digital divide, a multiple regression model was used, taking into consideration the penetration rate as a dependent variable (PR) at regional level, and economic, cultural, demographic and regional technological factors as independent variables. The stepwise method used in the regression is a combination of Forward selection and Backward elimination .In this work, four models were defined, called Model 1, Model 2, Model 3 and Model 4, which take into consideration, as independent variables, economic factors, cultural factors, demographic factors and technological factors, respectively.

The variables taken into account in this analysis were extracted from various sources (ISTAT - Italian Statistics Institute, G. Tagliacarne Institute and so on). The economic factors taken into consideration in Model 1 were: added value per employee; total added value; total income; per capita income; total amount of

tourist businesses; firms with 250 employees or more; patents every 100 firms; entrepreneurial density every 100 inhabitants.

In Table 4 are reported the only two economic variables that express the linear relation with the penetration rate: the total added value and per capita income. The remaining variables do not express in a significant way a linear relation with the penetration rate. Our results agree with what the economic literature reports: economic values, such as per capita income, are the factors that greatly affect Internet diffusion in a country (Hargittai, 1999; Guillèn & Suarèz, 2001, Maitland & Bauer, 2001; Norris, 2001; Chinn & Fairlie, 2007). This means that regions with a high per capita income are in the first positions in the Internet use ranking. Model 1 explained approximately 70% of total variability ($R^2 = 0.703$). The fit to the model proved to be good and significant.

Model 2, based on the use of cultural factors as independent variables, took into consideration the number of ICT graduates; the number of graduates; the number of ICT graduates every 100 graduates; and the amount of employees involved in research and development. This choice was in line with the results of AMD Global Consumer Advisory Board (2002), which stated that, in Germany, the type of education received is one of the most discriminating elements affecting use of the Internet: 86% of people with a University degree by the year 2000 were on-line against 8% of people with a lower education level. While in China education seems to be more discriminating than income. In Korea the gap between users with a university education level and users with lower education is of 40%.

Other studies on the digital divide drew the same conclusions. Norris (2001) and Chinn & Fairlie (2007) found that the education level of a country together with the average standard of living are important factors that affect Internet use. Robinson et al (2000), after multivariate controls, affirmed that the impact that educational level has on Internet use, is two times greater than income.

At the regional level, the only variable of Model 2 that expresses in a significant way the linear relation with the penetration rate resulted the number of ICT graduates (Table 4). However, the fit to the model is very weak and it explains approximately 37% of the variability of Internet diffusion at a regional level ($R^2 = 0.370$).

According to the economic literature (Hansons, 2000), education consolidates skills necessary for Internet use, characterizes professions that encourage Internet use.

Demographic factors taken into consideration in Model 3 were: population; percentage of men and women (to verify for example if regions with a higher percentage of men are more inclined to use the Internet than other regions that have a higher percentage of women); population density per Km^2; the total amount of foreign people at regional level; and unemployment rate. The last one was added because, following Bimber (2000), income level and other resources are important but also the status of employees with a permanent job affects Internet use in a country.

The statistical analysis showed that in Model 3, the significant independent variables are constituted by population and unemployment rate. The other variables analyzed in the model have been eliminated as scarcely significant. The results obtained are shown in Table 4. As expected, the correlation, $\square$, between penetration rate and unemployment rate proves to be negative and rather different from zero ($\square = -0.750$), in accordance with the economic literature (Bimber, 2000).

In order to define the technological factors that cause the digital divide in Italy, in Model 4 different indicators were taken into consideration: the degree of digitalization calculated as weighted average by the indexes of territory coverage of infrastructures and connectivity services, such as optical fibre and broadband (ADSL, HDSL, SHDL) (Assinform, Milano); the degree of ICT specialization measured through the ratio between the concentration of ICT employees and the concentration of employees of all productive fields (Iuzzolino, 2001); the employees concentration index measured through the ratio between the number of ICT employees of the region and the number of national ICT employees (Iuzzolino, 2001); investments in information technology (IT) made by the regions, IT expenditure on the regional added value, IT expenditure per employed person.

As shown in Table 4, in Model 4 the only significant variable resulted to be the "number of firms ICT every 1000 inhabitants". Such model expresses approximately 58% of Internet diffusion variability. According to this study, and in agreement with the literature (Guillén & Suaréz, 2001; Kiiski & Pohjola, 2002; Chinn & Fairlie, 2007), infrastructures play an important role in causing the digital divide at local level. Even if the model resulted significant, the fit to the model does not prove to be high ($R^2 = 0.58$). However, it is greater than the fit to Model 2, which took into consideration factors related to education level (see Table 4). This means that the penetration rate registered by single regions increases in a slight

proportional way (presenting a not "strong" linear relation) with the increase of the number of ICT firms every 1000 inhabitants.

Table 4. Determinants of Internet Diffusion.

Variables		Coefficient	t-statistic	Standard error	Significance	R^2
Economic (Model 1)	Per capita income	0.001	4.452	0.000	0.000	0.703
	Total added value	1.954E-05	2.272	0.000	0.036	
Cultural (Model 2)	Number of ICT graduates	0.003	3.249	0.001	0.004	0.370
Demographical (Model 3)	Unemployment rate	-0.599	-5.969	0.100	0.000	0.733
	Population	7.119E-07	3.768	0.000	0.002	
Technological (Model 4)	Firms ICT every 1000 inhabitants	7.606	4.998	0.000	0.000	0.581

(The dependent variable is represented by penetration rate registered by Registrars at regional level. In the models OLS estimator was used).

4. CONCLUSION

This research identifies a crucial issue: the existence of a digital divide at local level. The penetration rate, calculated in relation with the number of Registrars, and the specialization rate, appear to confirm this trend. Few regions are specialized in comparison with the national average in ICT services supply. This is true, above all, for regions with a low unemployment rate and with high economic factors, such as high added value per employee and per capita income. Educational level in regions is also crucial. In fact, regions with high number of graduates specialized in ICT fields are more inclined to use Internet technology than those which register a number of graduates lower than the national average. Furthermore, regions that have a high number of firms specialized in ICT fields in relation to the number of inhabitants, are more inclined to use the Internet.

Therefore, regions that are in the last positions in economic terms are also in the last position in technological terms. This is probably due to the fact that low economic development is also associated with a lower interest in new technologies and their adoption. These results according to a report drawn up by OECD (OECD, 2005) could be of great relevance for Italian local administrations, which can give a strong impulse in supporting underdeveloped areas from a technological point of view and in making substantial investments in ICT technologies. In this way, they could reduce the clear gap existing at national, regional level. In fact, the governments can increase Internet diffusion through policies aimed at the deregulation of the telecommunications market and network interconnections, and addressed to those markets where regulations permit effective competition in the Internet Service Provider.

Furthermore, our research shows that the concentration of domain names registered under the ccTLD ".it" is very high, in fact only few Registrars register the total amount of domains at national level. As a matter of fact, analyzing the specialization rate, few regions result to have a specialization rate greater than the unit. Moreover a high rate of registrations results in those areas where competition is not present. The absence of competition was measured by the portion of domain names owned by Registrars in a given geographical area (North, Centre, South) and by the number of actors that supply ICT services (Registrars) in a given geographical area. Considering the macro-area level, the study shows that in the Centre, where the competition level is lower than the North and South (HHI index, the index that measures competitiveness in a territory, is greater in the Centre than in the North and South) the number of registered domain names is on average greater than the national average.

These results appear not in line with Greenstein & Prince (2004) which affirm that is absence of competition, Internet Service Providers are less motivated to intensify their services. However, it is necessary to remember that, here, only the domain name registration service were taken into consideration. Registrars could be specialized in other types of services, like Internet connectivity, electronic mail services, website design, etc.. Moreover, it must be underlined that areas that are more specialized in domain name registration are those presenting a competitive advantage, in terms of economics, culture and technology, over the others.

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