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Abstract: This article is aimed at analyzing the motivations on the part of firms to invest in websites. What are the drivers behind such investments? In order to address this issue, we have considered two alternative theoretical frameworks. The first relies upon resource-based theory; the approach herein states that firms with greater resources and competencies are expected to invest more heavily in Internet technologies, especially those firms present in rent-yielding markets (concentrated markets with strong entry barriers). The theory of industrial organization constitutes a second framework and leads to the alternative conjecture that firms should have more incentive to invest in a website when they are in highly-competitive markets. A website can indeed serve as a strategic means for creating artificial entry barriers and eliminating rivals. We have tested these two hypotheses using a French database and found the resource-based approach to be more relevant in explaining the drivers of website investment. In particular, firms tend to invest more in websites when markets are highly concentrated and little exposed to international trade.
Key words: Internet strategy, e-commerce, entry barriers, resource-based theory.

Information and Communications Technologies (ICT) have permeated the day-to-day life of European firms and significantly modified the way firms innovate, produce, sell, etc. In 2004, almost all European firms were equipped with computers and about 95% benefited from Internet access [1]. However, fewer actually possessed a website, especially in France, where only 55% of firms declared to have their own site. Moreover, sites are quite heterogeneous in their functionalities and contents: some offer limited services and content is seldom updated, whereas others feature considerable technical sophistication (numerous functionalities) and a significant amount of material. How can such heterogeneity be explained? What are the drivers behind investing heavily or moderately in a website? The goal of this article is to comprehend firms' rationale for their website investment decisions.

[1] Source: the United Kingdom Department of Trade and Industry Report (2004).

A sizable body of empirical literature exists on the determinants of firms' investments in Internet technologies (IT). Yet these investments are often modeled as a binary choice of technology adoption, i.e.: to be equipped with Internet access or not, to develop an Intranet or not, to have a website or not (see GALLIANO & ROUX, 2004, on French data; and DHOLAKIA & KSHETRI, 2004, on US data). We are seeking herein to extend the investigation by also modeling the amount or nature of IT investment, via decisions to invest in a basic website vs. a more sophisticated version and decisions to introduce transactional or commercial functionality vs. confine the site to being a "shop window".

In order to address this task, we have considered two alternative theoretical frameworks. The first concerns resource-based theory and the inherent approach states that firms with higher resources and competencies should invest more in Internet-based technologies, especially those firms present in rent-yielding markets (concentrated markets with strong entry barriers). The theory of industrial organization constitutes the second framework and leads to the alternative conjecture that firms should be more inclined to invest in a website when positioned within highly-competitive markets. A website can indeed provide a strategic means for creating artificial entry barriers and eliminating rivals (by extending market catchment, improving quality of service, etc.).

We have tested these two alternative hypotheses on a French database of firms located in the Brittany province with more than 10 employees. Data were collected by the French Institute of Statistics and Economic Studies (INSEE [2]) in early 2004. We used a sequential probit, whereby during an initial stage we estimated the determinants of having a website or not; the second stage was devoted to estimating the determinants of heavy vs. moderate website investment. To test the resource-based conjecture, we drew the distinction between more elaborate websites (multi-functional with regular updating) and basic sites ("shop windows"). The industrial organization conjecture was then tested by distinguishing between commercially-aggressive websites and "softer" sites (without transactional functionality). We found that the resource-based approach seems more relevant in explaining the various website investment drivers; in particular, firms tend to invest more heavily in Internet technologies when markets are highly concentrated and little exposed to international trade. The two

[2] This survey was partially funded by M@rsouin: Brittany Network for Research on the Information Society and Uses of the Internet.

approaches prove however to be complementary in understanding the rationale of website investment.

The remainder of this article will be organized as follows. In the next section, we will present the two alternative theoretical frameworks in detail. After describing the database, we will discuss the econometric method along with the variables used to model website investment choices. Regression results will then be displayed and commented.

■ Theoretical frameworks

We will successively consider the resource-based and industrial organization approaches, which have given rise to two alternative hypotheses concerning the relationships between market structure and website investment incentives.

The resource-based approach

According to resource-based theory, a firm is defined as a collection of resources and capabilities (PENROSE, 1959; BARNEY, 1991; FOSS, 1998). Resources consist of inputs used in a firm's production process: physical and immaterial capital, human capital, organizational capital. By continuously acquiring and developing resources and capabilities, a firm can achieve a sustainable competitive advantage that yields economic rents. The resource-based view emphasizes that strategies chosen by a firm are strongly driven by the internal environment (i.e. existing resources and competencies [3]), which means that a firm conceives its strategy as a fit between internal capabilities and external opportunities. Through strategic action, a firm seeks to exploit its (internal) resources towards rent-yielding (external) activities.

ICT investments may be contained within a resource-based strategy. Although such investments require certain resources and competencies, in return they can become a new specific asset and reinforce the firm's competitive advantage for the future. By the means of a website, a firm can

[3] Competencies would include labor force skills, knowledge and routine. See NELSON (1998).

indeed seize Internet-related opportunities by selling its products online [4] or providing information and additional services to customers. The resources dedicated to a website enable a firm to reduce retailing costs [5] and/or increase market share and revenues, thereby creating additional economic rent (provided that the firm has sufficiently invested in its website).

We can conjecture that well-established firms (in terms of market share, financial assets, experience, reputation, number of employees, etc.) would possess greater resources and capabilities for investing in Internet technologies and could better exploit the business opportunities generated by a website. Such firms are more likely to be organized with an information systems department (with computer engineers on staff). They are thus able to internalize the creation and maintenance of their site [6], knowing that an in-house website offers the advantages of creating additional synergy with existing resources and capabilities and of facilitating the integration of this new asset into the firm's global strategy [7].

A second conjecture concerns the relationship between market structure and size of investment in Internet technologies. It could be expected that economic rent is higher in concentrated markets with stronger entry barriers. In such markets, firms set prices well above marginal costs and extract considerable profit. For DEMSETZ (1973), the correlation between industry concentration and average sector profitability observed in many empirical studies might only reflect the higher-efficiency rents earned by leading firms within concentrated industries [8]. Moreover, concentration provides a source of stability, enabling incumbent firms to better exploit their resources and capabilities. A recent study using Japanese data has concluded that "highly-concentrated industries feature strong entry barriers and therefore the

[4] We have adopted a broad definition of electronic commerce in this paper; it encompasses both online direct transactions and online-influenced transactions, i.e. transactions initiated on the website of a firm even if they wind up being concluded or cleared within the firm's physical retailing channel.

[5] Through automation of the ordering process, the reduction in menu costs or the reorganization of production (just-in-time process, flexibility, total quality management, etc.).

[6] A website generates maintenance costs for updating information and cataloguing products (at least once a month), as well as for providing tools and applications (a system of frequently-asked questions, forum, secured online payment system, etc.).

[7] Moreover, well-established firms, through their goodwill and brand names, incur lower costs in setting up a website, as compared to small firms or pure Internet players. The latter are required to spend heavily in order to advertise their site and build their reputation.

[8] See, for example, the sector-based studies of COTTERILL (1986) and MARION (1989), along with the survey conducted by SCHMALENSEE (1989).

turbulence among firms once they have entered remains low. In concentrated industries, the magnitude of firm exit proves relatively small and industry structure is likely to be stable" (DOI, 1999, p. 5). Consequently, firms in weakly-competitive markets will have more resources to invest in Internet technologies and added incentive to do so, given that uncertainty in the level of return from these investments is limited in such markets (i.e. it is easier to transform ICT investments into a specific rent-yielding asset).

The industrial organization (IO) approach

The second framework (adopted from the theory of industrial organization) focuses on the strategic interactions between firms and considers that investments are not only driven by internal efficiency, but also reflect market strategic issues. Firms can either over-invest or under-invest in order to eliminate rivals or relax competition. From this perspective, a website takes the form of a strategic investment. This view is supported in GEROSKI & MARKIDES (2004). The authors propose an insightful typology of innovation based on two dimensions: impact of the innovation on the advantages acquired by existing competitors (i.e. whether depreciating or not their competitive advantage); and the effect (minor or major) of the innovation on consumer habits and behavior. They emphasize four types of innovation: *incremental innovation* (resp. *major innovation*) that enhances the position of established firms, with minor (resp. major) effects on consumers; and *strategic innovation* (resp. *radical innovation*) that depreciate the existing advantages of incumbent firms, with minor (resp. major) effects on consumers (see Table 1). The Internet can be classified as a *strategic innovation*, by means of offering an alternative retailing channel and enabling firms to implement new business models (services, pricing, etc.). For customers, e-commerce does not indeed represent a radical innovation, but instead a complementary channel for buying tangible products and obtaining additional services (minor effect on consumer habits). For well-established firms, the Internet (through "pure" players, like Amazon) can however challenge and destabilize their current business models. In response to this challenge, an incumbent firm can decide to invest in a website.

Investing in a website can strengthen the incumbent firm (i.e. make the firm tougher), by virtue of deterring the entry of pure players or avoiding preemption of the Internet market by one of its rivals. According to FUDENBERG & TIROLE (1984) and their animal taxonomy, tough

investments encourage a firm to over-invest and adopt a "Top Dog" strategy should prior motivation have focused on eliminating existing or potential competitors. With respect to websites, a Top Dog strategy consists of investing in transactional functionalities; through a commercial website, a firm can credibly appear as a Top Dog with the ability to reduce operational costs, set aggressive prices and wrest market share from rivals (BESANKO *et al*., 2003). We are conjecturing here that the incentives to invest in Internet technologies, and particularly in a commercial website, should be higher in industries characterized by low entry barriers or low sunk costs. In such industries, incumbent firms are being encouraged to over-invest in order to erect artificial entry barriers.

Table 1 A typology of innovation

	Enhance the position of incumbent firms	Depreciate the position of incumbent firms
Minor effect on consumer habits	*Incremental innovation*	*Strategic innovation*
Major effect on consumer habits	*Major innovation*	*Radical innovation*

Source : Geroski & Markides (2004)

Testable hypotheses

The two approaches developed above will now enable us to formulate alternative testable hypotheses concerning relationships between market structure and website investment incentives. First, the resource-based approach emphasizes that well-established firms have greater resources and competencies available for investing in Internet technologies. Furthermore, the amount of investment will be driven by market structure. An industry characterized by a low degree of competition offers an improved prospect of economic rent generated from ICT investments.

> Hypothesis 1: A firm should be more heavily incited to invest in a website in a less competitive (rent-yielding) market that displays lower uncertainty for investment return.

The second framework considers investment in a website as a strategic innovation that enables deterring entry or eliminating rivals. Consequently, the amount of investment should increase with the expected gain in terms of competitive advantage. This gain increases when the threat of entry is serious or when current competition is intense.

Hypothesis 2: A firm should be more heavily incited to invest in a website in a highly-competitive market in order to erect artificial entry barriers and destabilize rivals.

We then tested these competing hypotheses using data from 850 French firms located in Brittany (western France). The next section will describe the database.

■ Data

Data were collected by the French National Institute of Statistics and Economic Studies (INSEE) in early 2004. A survey on ICT use was sent [9] by post to a sample of 1,852 commercial and industrial establishments [10] located in Brittany with more than 10 employees; approximately 850 responses were received (for a 45.89% response rate). The sample is representative in terms of sector, size and location [11]. Data were also included from the Unified Enterprise Statistics System [12], in order to obtain additional information on sectorial characteristics (sector-based concentration and capital intensity), as well as from the General Board of Customs to calculate the rate of openness within those sectors covered by our survey [13].

96.4% of the respondents are equipped with computers and 84.59% have Internet access. Furthermore, 54.71% (i.e. 465 establishments) declare possessing their own website, yet 43% of these sites are shared with other firms or establishments within the same group (i.e. a non-specific website). The Appendix of this article offers a full description of the survey data.

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[9] We have excluded ICT-sector firms from the survey.

[10] An establishment is a place of business (plant, store, etc.) that has been identified as an autonomous entity by the French administration. A firm may be composed of several establishments.

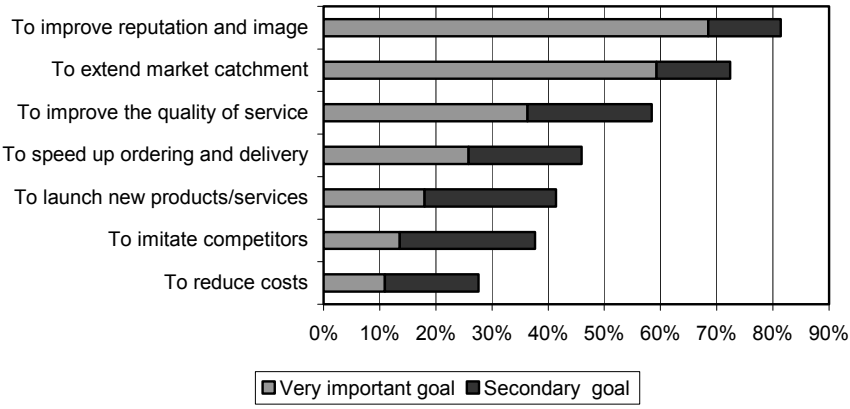
[11] Representativeness in terms of rural and urban location.

[12] The Unified Enterprise Statistics System (UESS) combines two sources of information: a survey of firms' tax declarations focusing on their revenues and profits, and an annual survey. The data are available at a highly-disaggregated level.

[13] The rate of openness is obtained at a NES 36 level (the French Synthetic Economic List at the 36th level). The corresponding formula is given by: $\frac{\frac{Exports + imports}{2}}{Sum\ of\ added\ value} \cdot 100$

Figure 1 displays the main motivations for creating a website; the associated investments are aimed both at increasing sales and market share (to extend market catchment and goodwill, launch new products) and at improving customer satisfaction and loyalty (to enhance reputation and service quality and delivery). Cost-cutting only appears in seventh place among the objectives mentioned.

Figure 1: The main objectives of a website

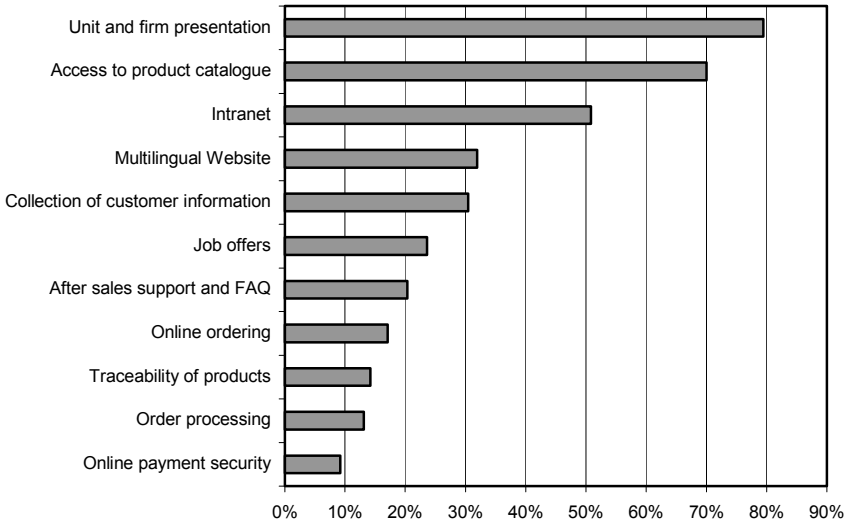


Note: For 81% of establishments with a website, the goal of this investment has been to improve image, , while for more than 70% it has been to extend market catchment.

Establishments were also surveyed on the functionalities of their websites. Figure 2 ranks the various functionalities and applications available on the 465 websites inventoried in our sample; the majority of them integrate a presentation of the firm (history, activity, organization, etc.). The second most frequent function is online access to the product catalogue. Half of the sites feature an Intranet (i.e. a portion is dedicated to internal use). Transactional functions are less well-developed: only 17% of the sites offer online ordering and just 9% have introduced a secured online payment system. Customer relationship management has not yet become a major website function: order tracking and after-sales support is present on fewer than 20% of the sites. In addition, only 35% get updated at least once a month.

For the purpose of analyzing website investment volumes, we established a classification of sites based on available functionalities and updating frequency. Two classification criteria were applied to correspond with the two theoretical hypotheses set forth above.

Figure 2. Major website functionalities



Note: Presentation of the firm and/or establishment is provided in 79% of the sites sampled.

The first criterion refers to the resource-based approach and distinguishes basic from more elaborate websites, with the latter required to exhibit at least three functions (from among the eleven listed in Figure 2) and an updating frequency of at least once a month. 138 of the 465 sites surveyed wound up satisfying this definition. A basic website would be more along the lines of a "shop window" and only requires limited resources and competencies, but cannot yield economic rent. An elaborate site, on the other hand, is resource-consuming, yet can become one of the firm's specific assets and generate efficiency rent.

We also used a second classification criterion for testing the IO conjecture; we established a distinction between more accommodating websites and more aggressive ones, with the latter being characterized by transactional functionalities (at least one of the following functions being available: online ordering, secured online payment system, order monitoring and/or product tracking) and updates on at least a monthly basis. 71 websites in all satisfied this criterion and are likely to exert a strategic impact on both existing and potential competitors.

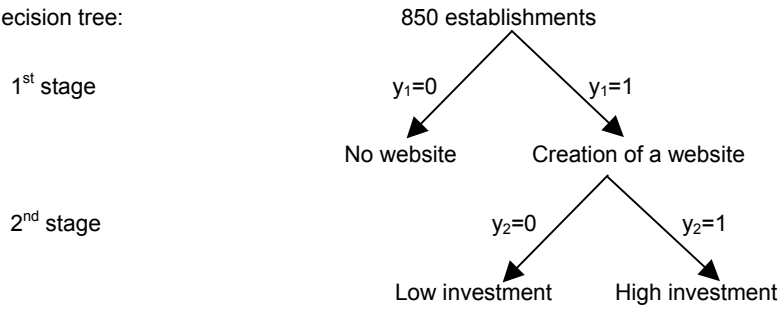
The next section will present the econometric method and variables used to explain the choice between a basic vs. elaborate website as well as between an accommodating vs. aggressive site.

■ Empirical results

We will now analyze the website investment decisions thanks to a sequential probit model. The methodology is presented in Box 1.

Box 1. Methodology

Investment decision tree:



The sequential probit model consists of successively estimating two binary probit models: 1) whether or not to create a website during the first stage and 2) whether or not to invest large amounts during the second stage [(*)]. Our dependant variable (y_{is}) is dichotomous at both stage (s = 1,2). In the first stage, y_{i1} is ascribed the value 1 if the establishment has a website and 0 otherwise; in the second stage, y_{i2} assumes the value 1 if the establishment heavily invests (elaborate or aggressive website) and 0 otherwise.

The unobserved latent variable (y^*_{is}) corresponds at each stage to the net profit (or economic rent) obtained by the firm (i = 1,...,n), when creating a website (in the first stage), and when heavily investing (in the second stage) in either an aggressive or elaborate website.

The latent variable is given by: $y^*_{is} = \beta'_s x_{is} + \mu_{is}$

$\begin{cases} y_{is} \text{ assumes the value 1 if } y^*_{is} > 0 \\ \text{and } y_{is} \text{ assumes the value 0 if } y^*_{is} \leq 0 \end{cases}$

$P(y_{is}=1) = P(y^*_{is} > 0) = P(\beta'_s x_{is} + \mu_{is} > 0) = P(\mu_{is} > -\beta'_s x_{is})$

$= 1\text{-}F(-\beta'_s x_{is})$

$P(y_{is}=0) = P(y^*_{is} \leq 0) = P(\mu_{is} \leq -\beta'_s x_{is})$

$= F(-\beta'_s x_{is})$

where *F* represents the cumulative distribution function.

The log-likelihood function can then be rewritten as:

$$LogL = \sum_{i=1}^{n} [(y_{is} \log(1 - F(-\beta'_s x_{is})) + (1 - y_{is}) \log F(-\beta'_s x_{is})]$$

To obtain the estimated parameters ($\hat{\beta}_s$), we maximized the log-likelihood function presuming that the error term is distributed normally n with a mean equal to 0 and variance equal to σ^2. We must transform this normal law N(0, σ^2) into a standard normal law N(0,1), which entails dividing y^*_{is} by σ in order to obtain $y^*_{is}/\sigma = \beta'_s x_{is}/\sigma + \mu_{is}/\sigma$. If $\mu_{is}/\sigma = \varepsilon_{is}$, then ε_{is} follows a standard normal law N(0,1). Both the density function and the cumulative distribution function with such an error term are respectively:

$$f = \frac{1}{\sigma\sqrt{2\pi}}.\exp\left[(-1/2)\cdot(\varepsilon_{is})^2\right]$$

and $$F = \int_{-\infty}^{-\beta'_s x_{is}/\sigma} \frac{1}{\sigma\sqrt{2\pi}}.\exp\left[(-1/2)\cdot(\varepsilon_{is})^2\right]\cdot d\varepsilon_{is}$$

In order to identify the coefficients β associated with σ, we normalized the standard error σ to 1.

(*) A sequential probit model requires that the choice in the second stage be independent of the choice in the first stage, i.e. the correlation between error terms is nil. To check the absence of correlation, we have used a test of independence (LR test) between first- and second-stage equations. This test is based on a chi-square distribution with one degree of freedom.

Variables introduced and expected effects

Some of the explanatory variables are used in both stages (characteristics of the establishment, and characteristics of the firm that owns this establishment), while others have only been introduced during the second stage (market structure, use of ICT).

First stage

To explain the decision of whether or not to create a website, we considered features specific to the establishments: their location (urban vs. rural), and the period during which they have occupied their current premises (more or less than 5 years). We also took into account the characteristics of the firm owning the given establishment, i.e.: number of employees (10-19, 20-49, 50-99, 100+), main sector of activity (agro-food processing, consumer goods, automotive and equipment, intermediate goods, services, transportation, retail), age (< 10 years, 10-20 years, 20+ years), and organizational structure (multi-establishment firm, subsidiary of a group). We also introduced descriptive variables for the level of equipment and use of ICT in order to measure ICT resources and capabilities of the establishments: presence of a local computer network, mobile phones, pocket digital agendas for employees, and Internet access.

According to the literature on ICT adoption and use by firms (especially GALLIANO & ROUX, 2004; DHOLAKIA & KSHETRI, 2004), we can presume that those establishments belonging to a well-established firm (in terms of age and size of workforce) and/or a group are more likely to set up a website, due to their broader collection of resources and competencies. A complex organization (multi-establishment firm) is expected to make use of a website to facilitate coordination among the various establishments (through the function of an Intranet system). Moreover, previous ICT investments may serve to facilitate the creation of a website. An establishment will be better able to set up a website if it is well-equipped or familiar with ICT.

Second stage

The second-stage probit employs the same explanatory variables as the first stage, except for the sectorial dummies that are replaced here by three new variables: concentration ratio of the four biggest firms (usually denoted CR4 [14]), capital intensity, and the rate of openness to international trade. These three variables are aimed at measuring the degree of competition faced by the firms. We introduced additional variables as well to characterize the activity of the establishment: a dummy variable indicates whether the establishment is the headquarters of the firm. Two other dummy variables indicate whether the establishment concludes over 30% of its sales with a single customer and whether it transacts over 30% of its purchases with a single supplier.

The resource-based conjecture is tested through firm characteristics and market structure. The size and age of the firm, along with its eventual membership in a group, are used as proxies for its endowment in resources and competencies. Concentration ratio, capital intensity and rate of openness to international trade serve as proxies to measure entry barriers and degree of competition.

The anticipated effects of these internal and external factors on the amount of investment in a website are presented in Table 1. We can also expect that the presence of other ICT acts to stimulate website-related investment (complementarity among information and communication technologies). The existence of a call center, EDI (Electronic Data

14 This corresponds to the sum of market share for the four biggest firms.

Interchange) or ERP [15] (Enterprise Resource Planning) thus indicates the accumulation of ICT capabilities and reduces the cost and risk associated with setting up a website.

The IO conjecture is tested through the three market structure proxies. Here, the expected sign of concentration, capital intensity and rate of openness are the inverse of those expected with the resource-based conjecture (see Table 2). We have presumed that firms are more inclined to invest in an aggressive website if they are positioned in a highly-competitive and open sector. The expected return of a "Top Dog" strategy is indeed higher in such markets, especially when the firm has the possibility to erect artificial entry barriers.

Furthermore, the presence of a call center or ERP could be correlated with an aggressive website, inasmuch as such tools can prove complementary in selling products and services rapidly to remotely-located customers (synergy with e-commerce). Lastly, we have introduced a dummy variable that equals 1 if the firm is involved in a business-to-consumer activity and 0 for a business-to-business activity. This variable enables investigating whether the Internet strategies implemented are more aggressive on upstream markets (intermediate markets) or downstream markets (end markets).

Table 2: Expected effects of firm and market characteristics

	Investment in an elaborate website (*1st classification*)	*Investment in an aggressive website* (*2nd classification*)
	Internal motives	Strategic motives
Number of employees, Subsidiary of a group	+	?
Age of the firm	+	?
Concentration (CR4)	+	-
Rate of openness	-	+
Capital intensity	+	-

[15] EDI enhances information transmission between a firm and its suppliers and/or customers, thereby reducing transaction costs and inventory costs. An ERP is a business management system that attempts to integrate and optimize all functions of the firm, including planning, manufacturing, sales and marketing.

Econometric results

First stage

Results from the first stage binary probit are presented in Table 3 [16].

Econometric results show good conformity with the literature on adoption of Internet technologies. We have identified a positive influence from the proxies for human and financial resources (number of employees, group membership). Moreover, investments in ICT tend to be complementary: the presence of a local computer network, mobile phones, Internet access and PDA increases the likelihood of having a website. Complex organizations (multi-establishment firms) are more inclined to set up a website; a multi-establishment organization displays a 13.2% greater probability of website generation. We also discovered that firms created between 1983 and 1993 have a higher probability of owning a website, ceteris paribus. In addition, sectorial effects may be observed: firms in industrial sectors (durable goods, intermediate goods, consumer goods) are more likely to create a website. Sectorial effects are not related to a size effect since industrial sectors are not more heavily concentrated than the service and retail sectors.[17]

Second stage

Tests of the two conjectures were conducted on a sample of 427 establishments that had declared owning a website and had answered all items in the questionnaire. The econometric results for the resource-based approach are displayed in Table 4.

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16 The econometric regression has been conducted on 805 observations (some surveyed establishments were removed because of non-response for some of the explanatory variables). This table provides both the estimated coefficients and the marginal effects associated with the set of explanatory variables. The marginal effects of an explanatory factor may be interpreted as the variation in the probability of having a website in response to a 1% variation for a continuous variable or in response to switching from 0 to 1 for a dummy variable.

17 The average CR4 and the average number of employees are respectively equal to 23 and 98 in agrofood, 28 and 47 in consumer goods, 26 and 56 in automotive and equipment good, 26 and 50 in intermediate goods, 22 and 50 in retailing, 8 and 60 in transportation, 33 and 51 in services.

Table 3: The determinants of possessing a website

Variable	*Coefficient*	*Marginal effect*
Firm characteristics		
Size between 10 and 19 employees	Ref.	
Between 20 and 49 employees	ns	
Between 50 and 99 employees	0.3413** (0.1479)	0.132
100 employees or more	0.3575** (0.1826)	0.1374
Multi-establishment organization	0.3362*** (0.1074)	0.1322
Subsidiary of a group	0.3661*** (0.1072)	0.144
Agro-food industry	Ref.	
Consumer goods industry	0.5384* (0.2890)	0.1995
Automotive and equipment industry	0.4919** (0.2386)	0.1852
Intermediate goods industry	0.4797** (0.2313)	0.1813
Retailing	ns	
Transportation	ns	
Professional services	ns	
Less than 10 years old	Ref.	
Age of between 10 and 20 years	0.1197* (0.2095)	0.0516
20 years or older	ns	
Establishment characteristics		
Located in an urban area	ns	
5 years or more in current premises	-0.2946** (0.1388)	-0.1146
Prior technology use		
Local computer network	0.3968*** (0.1424)	0.1573
Mobile phone for employees	0.2115* (0.1149)	0.084
Pocket Digital Agenda (PDA)	0.3997*** (0.109)	0.1563
Internet access	0.7988*** (0.1573)	0.3066
Constant	-1.5004*** (0.2873)	
Correctly classified	67.45%	
Pseudo R2	0.1567	
Log likelihood	-467.880	

*, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively. Standard errors are shown in brackets; ns: not significant; Ref.: reference group.

Note: The variable "subsidiary of a group" is significant at the 1% level. When a firm is member of a group, its probability of possessing a website is increased by 14.4%.

Table 4: Factors explaining investment in a multi-functional (elaborate) website

	Model 1		*Model 2*	
Variable	*Coefficient*	*Marginal effect*	*Coefficient*	*Marginal effect*
Business environment characteristics				
Rate of openness	-0.4518* (0.2589)	-0.1456	ns	
Four-firm concentration ratio (CR4)	0.0122*** (0.0033)	0.0039	0.0088** (0.0035)	0.0028
Capital intensity	ns		ns	
Firm characteristics				
Business-to-consumer	…		0.7117*** (0.1968)	0.2437
Size between 10 and 19 employees	Ref.		Ref.	
Between 20 and 49 employees	-0.3417* (0.1839)	-0.1052	ns	
Between 50 and 99 employees	ns		ns	
100 employees or more	ns		ns	
Subsidiary of a group	0.4607*** (0.1646)	0.1466	0.407** (0.1669)	0.1279
Less than 10 years old	Ref.		Ref.	
Age of between 10 and 20 years	-0.3381* (0.1973)	-0.1079	ns	
20 years or older	-0.4706** (0.2129)	-0.1432	-0.4848** (0.2173)	-0.1451
Establishment characteristics				
Located in an urban area	0.3340* (0.1860)	0.1011	ns	
The establishment is the head office	ns		ns	
5 years or more in current premises	0.4371** (0.20298)	0.1268	0.3657* (0.2053)	0.1063
30% or more of the establishment sales concluded with a single customer	-0.5401** (0.2596)	-0.1481	ns	
30% or more of the establishment purchases transacted with a single supplier	ns		-0.3333* (0.1885)	-0.0998
Prior technology use				
Other connection (ISDN, …)	Ref.		Ref.	
DSL connection	0.3779** (0.1841)	0.1259	0.4585** (0.1903)	0.1517
Leased lines	0.7342*** (0.1961)	0.2595	0.7801*** (0.1995)	0.274
Call center	ns		ns	
Enterprise Resource Planning	ns		ns	
Electronic Data Interchange	0.2707* (0.1495)	0.0886	0.2796* (0.1523)	0.0904
Website up and running for 3 years or more	ns		ns	
Constant	-1.7565*** (0.3605)		-2.0235*** (0.3770)	

LR Test	0.03	1.17
Correctly classified	76.11%	77.28%
Pseudo R^2	0.196	0.222
Log likelihood	-208.335	-201.533

*, **, and *** indicate statistical significance at the 10%-level, 5%, and 1% respectively. Standard errors are in brackets ; ns : non significant ; Ref. : reference group.

The results are indeed contrasted. The variables that measure firm resources and competencies exert a limited impact (i.e. size is not significant) or have the opposite effect (negative impact from age). However, membership in a group increases the probability of investing heavily in a website by 14.66% and when the establishment has been located in the same premises for more than 5 years, the probability of intense investment increases by 12.68%, ceteris paribus (locational stability can serve to enhance resource accumulation and facilitate the transformation of these resources into ICT assets).

More interestingly, the business environment exhibits the anticipated effect [18]. A relatively stable, well-protected market has a significant and positive effect on the choice of investing in a high-quality site. As such, a 1% increase in CR4 raises the probability of setting up an advanced website by just 0.4%, while a 1% increase in the rate of openness lowers the probability of investing heavily in a site by 14%.

The other explanatory variables yield insightful results. For example, being located in an urban area has a significant and positive impact. Urban areas provide easier and cheaper access to ICT and may reduce the cost of investing in an elaborate website. If the establishment realizes 30% or more of its turnover from a single customer, its incentive to invest in a website drops.

Furthermore, the probability of investing in a multi-functional website increases with the quality of the Internet connection (DSL connection or leased lines). This result underscores the strong complementarity in the amount of ICT investment. Similarly, the existence of EDI, a technology oriented towards optimizing production and distribution processes, raises the likelihood of an elaborate website.

[18] Nevertheless, the coefficient associated with sunk cost measurement is not significant.

In a second specification, we introduced the "Business-to-consumer" variable, which equals 1 if the firm exercises its activity in a downstream market and 0 if the firm is positioned in an upstream market. Firms that deal directly with end-consumers tend to invest more heavily in their website than firms dealing with business customers, which suggests that a website is a more strategic asset in downstream markets than upstream markets.

Table 5 displays the econometric results for the IO conjecture, which states that website investment is dictated by strategic considerations.

These results are less significant than in the resource-based model. Moreover, the conjecture that a market with low entry barriers should lead to more aggressive website investment has been rejected. Capital intensity is not significant, the rate of openness is significant yet negatively-correlated, and the degree of concentration is also significant but with a positive correlation.

Strong competition seems to be preventing firms from investing in a commercial or aggressive website. Conversely, well-established firms operating in protected markets are more likely to invest in transactional functionalities. In this manner, they strengthen existing entry barriers and increase their market power.

The resources owned by a firm exert no influence on the strategic decision to invest in an aggressive website. The complementarity between this type of site and other ICTs is also weak, except for ERP. By increasing organizational flexibility and reactivity, an ERP approach may facilitate setting up a commercial website. Moreover, a website that has been up and running for at least three years increases the probability of investing in transactional functionalities by 6.8%. Implementing such functionalities perhaps requires a learning process that could last several years.

In the second specification with the business-to-consumer dummy, we obtained a positive impact. The decision to invest in an aggressive website strongly depends on the nature of customers.

Firms feel greater incentive to invest in a commercial website when exposed to consumers (downstream markets) rather than business customers (upstream markets). Strategic issues (deterring entry, preempting markets) are thus more prevalent in downstream markets.

Table 5: Factors explaining investment in a commercial website

	Model 1		*Model 2*	
Variable	*Coefficient*	*Marginal effect*	*Coefficient*	*Marginal effect*
Business environment characteristics				
Rate of openness	-1.1726*** (0.3406)	-0.2213	-0.8864** (0.3598)	-0.1639
Four-firm concentration ratio (CR4)	0.0109*** (0.0037)	0.0021	0.0073* (0.0040)	0.0014
Capital intensity	ns		ns	
Firm characteristics				
Business-to-consumer			0.6117*** (0.2268)	0.1322
Size between 10 and 19 employees	Ref.		Ref.	
Between 20 and 49 employees	ns		ns	
Between 50 and 99 employees	ns		ns	
100 employees or more	ns		ns	
Subsidiary of a group	ns		ns	
Less than 10 years old	Ref.		Ref.	
Age of between 10 and 20 years	-0.3829* (0.2152)	-0.0714	-0.3649* (0.2198)	-0.0667
20 years or older	-0.5714** (0.2427)	-0.0969	-0.5435** (0.2465)	-0.0907
Establishment characteristics				
Located in an urban area	ns		ns	
The establishment is the head office	ns		ns	
5 years or more in current premises	ns		ns	
30% or more of the establishment sales concluded with a single consumer	ns		ns	
30% or more of the establishment purchases transacted with a single supplier	ns		ns	
Prior technology use				
Other connection (ISDN, …)	Ref.		Ref.	
DSL connection	ns		ns	
Leased lines	ns		ns	
Call center	ns		ns	
Enterprise Resource Planning	0.3505* (0.1795)	0.0703	0.3596** (0.1810)	0.0709
Electronic Data Interchange	ns		ns	
Website up and running for 3 years or more	0.3500** (0.1746)	0.068	0.404** (0.1786)	0.0773
Constant	-1.4507*** (0.4092)		-1.637*** (0.4216)	
LR Test	0.55		1.13	
Correctly classified	86.42%		87.59%	
Pseudo R2	0.209		0.229	
Log likelihood	-146.712		-143.072	

*, **, and *** indicate statistical significance at the 10%-level, 5%, and 1% respectively. Standard errors are in brackets ; ns : non significant ; Ref. : reference group

■ Conclusion

This article has proposed two alternative approaches (inspired from resource-based theory and industrial organization theory) to understand the motivations of firms for investing in a website. The first approach focuses on firms' resources and competencies as the main drivers behind investments in Internet technologies, whereas the second highlights strategic interactions between competitors. These two theoretical frameworks lead to contradictory conjectures on the relationship between market structure and the amount of website investment. The resource-based conjecture establishes that a weakly-competitive market (strong entry barriers, intense concentration) favors heavy website investment, whereas the industrial organization conjecture presumes the inverse impact. Econometric estimations would tend to validate the resource-based conjecture. Elaborate websites are more likely to appear in protected markets.

One limitation of this empirical study lies in the way the degree of competition gets measured. Rough proxies were used at the sectorial level, which is imperfectly relevant for characterizing the playing field competition of the surveyed establishments. Future research should address this limitation by integrating, in forthcoming surveys sent to firms, specific questions on market structure and competition as perceived by managers.

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Appendix: Survey data description

	Whole sample		*Firm owning a website*	
	Mean	*Std. Dev.*	*Mean*	*Std. Dev.*
Business environment characteristics				
Rate of openness			0.3338	0.3082
Four-firm concentration ratio (CR4)			0.2693	0.2438
Capital intensity			42.3110	37.1921
Firm characteristics				
Business-to-consumer			0.2796	0.4493
Size between 20 and 49 employees	0.3271	0.4694	0.3140	0.4646
Between 50 and 99 employees	0.1565	0.3635	0.1914	0.3938
100 employees or more	0.1094	0.3123	0.1484	0.3559
Multi-establishment organization	0.4224	0.4942		
Subsidiary of a group	0.4588	0.4986	0.5376	0.4991
Consumer goods	0.0447	0.2068		
Automobile and equipment goods	0.0918	0.2889		
Intermediate goods	0.1035	0.3048		
Retailing	0.3471	0.4763		
Transportation	0.1141	0.3181		
Professional services	0.2094	0.4071		
In business for between 10 and 20 years	0.4370	0.4963	0.4685	0.4996
In business for 20 years or more	0.3550	0.4788	0.3446	0.4758
Establishment characteristics				
Located in an urban area	0.7388	0.4395	0.7591	0.4281
The establishment is the head office			0.6925	0.4620
5 years or more in current premises	0.8389	0.3679	0.8290	0.3769
30% or more of the establishment sales concluded with a single consumer			0.1140	0.3181
30% or more of the establishment purchases transacted with a single supplier			0.2495	0.4332
Prior technology use				
Local computer network	0.8280	0.3776		
Mobile phone for employees	0.7094	0.4543		
Pocket Digital Agenda	0.3682	0.4826		
Internet access	0.8459	0.3613		
DSL connection			0.3341	0.4722
Leased lines			0.2473	0.4319
Call center			0.2215	0.4157
Enterprise Resource Planning			0.3699	0.4833
Electronic Data Interchange			0.3978	0.4900
Website up and running for 3 years or more			0.4464	0.4977