

IS THE INTERNET DELIVERY CHANNEL CHANGING BANKS' PERFORMANCE? THE CASE OF SPANISH BANKS

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Abstract

In spite of the conspicuous use of the Internet as a delivery channel, there is a relative dearth of empirical studies that provide a quantitative analysis of the impact of the Internet on banks' financial performance. This paper attempts to fill this gap by identifying and estimating the impact of the adoption of a transactional web site on financial performance using a sample of 72 Spanish commercial banks over the period 1994-2002. Since brokerage is one of the main drivers used for banks for acquiring new customers on-line, the paper also analyzes the impact on the performance of the multichannel banks of the provision of on-line brokerage. The impact on banks' performance of transactional web adoption (or the broker on line business model) seems to vary over time. The adoption of the Internet as a delivery channel has a positive impact on banks' profitability (ROA and ROE) after one and a half years, mainly explained by the lower overhead expenses and, in particular, staff and IT costs after the same period. The paper also concludes that the Internet is used as a complementary mean of transacting rather than a substitute for physical branches/ATMs.

Keywords: commercial banks, Internet banking, profitability, cost and income structure.
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1. Introduction

By the time of writing this paper, expectations on the impact of information technologies in general and the Internet in particular on retail banking are more realistic and far from the revolutionary views existing at end of the 90s or the turn of this century (see as an example of these views Feng, 2001). The general consensus is that the Internet simply adds another delivery channel to the existing channels (ATMs, branches, telephone). Nonetheless, in spite of the success of the multichannel model, few empirical studies are available on the impact of Internet on the financial performance of multichannel banks. Frame and White, (2004, pp.126 and 127) describe some of the most recent studies in the U.S. and *"urge fellow finance economists to expend some effort toiling in this untilled field"* (p. 137).

This paper attempts to fill this gap by identifying and estimating the impact of Internet as a delivery channel on the financial performance of commercial banks in Spain. Spanish banks have not been an exception in the adoption of transactional web sites. Moreover, their adoption strategy has been in line with the current world wide trend toward a multi-channel ("clicks and mortar") approach. Adoption started in the late 1990's and by 2002, 55 percent of the commercial banks operating in Spain were using the Internet as a distribution channel mainly for money transfers, brokerage and securities trading transactions and deposits. For the purpose of this paper, multichannel banks are those that use traditional distribution channels (i.e. branches and ATMs) as well as telephone and Internet. Hence, the primarily Internet banks are also included in our sample since they use, although in a lesser degree, more traditional delivery channels².

The purpose of this paper is to identify and estimate the impact of the adoption of transactional web sites on operational performance and overall risk profile of commercial banks operating in Spain. To this end, we explore the impact on profitability, operational performance ratios and the Pearson coefficient of stock returns of the adoption of the Internet as a distribution channel, using a sample of 72 commercial banks over the period 1994-2002. Since brokerage is one of the main

² They do have at least one-full-service physical office.

drivers used for banks for acquiring new customers on-line, we also compare the different performance of those Internet banks that provide on-line brokerage and trading with that of those Internet banks which have transactional web sites but do not offer this financial service over the same seven year period.

The paper uses information from the regulatory data base of Banco de España and from Datastream. It also draws from a voluntary survey carried out by Banco de España on Internet adoption of all depository institutions operating in Spain. We have also used information from the individual banks' web sites. The data base includes 72 commercial banks accounting for nearly all Spanish bank deposits during this time. The data corresponds to three samples: Banks without transactional web site which may or may not have informational web site (*traditional banks*); banks with transactional web site (*multichannel banks*) and banks with transactional web site that offer on-line brokerage and securities trading (*on-line brokers*).

Our results suggest that Internet is used as a complementary mean of transacting rather than a substitute for physical branches/ATMs and that the impact of Internet on banks' performance varies over time. The adoption of the Internet as a delivery channel has a positive impact on profitability (ROA and ROE) and overhead expenditures, in particular, staff and IT costs as compared with the traditional banks after one and a half years since adoption. Moreover, multichannel banks obtain higher brokerage fees than traditional banks after six months since adoption. However, banks that adopt the broker on-line business model do show a statistically significant difference neither in profitability nor in brokerage fee income as compared to multichannel banks that do not adopt this business model. Multichannel banks do not show statistically significant differences in the overall risk profile as compared to traditional banks. A note of caution must be introduced given the preliminary character of the findings of this study that does not take into consideration the intensity of the use of Internet as a delivery channel as well as the broker on-line business model.

This article is divided in five parts in addition to this Introduction. The second part describes the characteristics of the multichannel banks in Spain. Part three presents the financial literature on Internet banking in other countries. The fourth part describes the data and the sources as well as the results of a preliminary financial analysis of the three

samples of banks. Part five presents the regression framework and the results of the multivariate analysis. Finally, section six summarizes the article and presents the conclusions.

2. Multi channel banks in Spain

The rapid development of the technology infrastructure, in particular the growth in the number of personal computers, the increased quality of Internet connections, the more widespread use of the Internet in both homes and businesses, and the significant reduction in both the fixed and variable costs of the Internet connections in Spain have made possible that the Internet plays a more central role in banks' business strategy (Delgado and Nieto, 2004). Also, Spanish banks benefited specially from the adoption of the Internet because of their universal character. As many European banks -unlike the US banks before the Gramm-Leach-Bliley Act of 1999-, Spanish banks have enjoyed the advantages of "broad banking" (Barth, Brumbaugh and Wilcox, 2000). Banks have been allowed to offer all sorts of financial products and engage in a wide variety of financial business (including securities trading and mutual funds management). Carbó and Rodriguez (2005) find that cost and profit global scope economies improve significantly when including mutual funds along with other earning assets, showing certain cross-selling and portfolio diversification benefits in the Spanish banks.

The Banco de España carried out a voluntary survey among all deposit institutions operating in Spain with the objective of determining the nature of the institutions' Internet-based financial activities.³ The period covered by the survey was 2000-2002. The data obtained from the replies to the questionnaire reveal that the financial products delivered over the Internet by commercial banks with a multi-channel strategy were money transfers, brokerage (stocks and mutual funds), deposits and mortgage loans. Multichannel banks offer economic incentives to their clients to shift their operations

³ A total of 121 institutions (63% of total number that represents 97% of the total owners' equity of the Spanish banking system) responded to the survey (14 of which were branches of non-Spanish banks). Of these, 87 institutions stated that they provided services over the Internet (one of these is the Spanish branch of a bank based in another European Union Member State) and 34 institutions stated that they did not provide services over the Internet (6 of these are the Spanish branches of banks based in another European Union Member State and 7 are branches of banks based outside the European Union).

from the traditional distribution channels to the Internet.⁴ These economic incentives are mainly more competitive interest rates on deposits and loans and lower commission fees for their banking services. The uneven quality of the data submitted seems to reveal the limitations of multi channel banks' accounting records as a means of differentiating operations by different distribution channels.

By 2002, nearly 55 % commercial banks had incorporated the Internet as a delivery channel, while 76 % commercial banks had web sites only for informational purposes in Spain. These data compare favourably with the Internet banking adoption in the US where the estimated adoption rate was approximately 50% by end-year 2000 (Carlson., Furst, Lang and Nolle, 2000). Nonetheless, despite the growing importance of the Internet distribution channel, the branch network remains the most important delivery channel for retail banking in Spain. According to the European Central Bank (2005), the Spanish is one of the most "over branched" banking systems in Europe, although commercial banks have been reducing the number of branches over the past years. Differently from other European countries, branches of Spanish banks have a lower number of employees per branch. Branches have minimal administrative duties and they are almost solely used as a distribution channel. According to Standard & Poors (2004), new branches may have as few as three people per branch.

In Spain, transactional web site adoption rates seem to depend on commercial banks' size in line with the findings of Furst, Lang, and Nolle (2002) for the US banks and Hasan, Zazzara and Ciciretti (2005) for the Italian banks. In 2002, all but one medium size bank had a transactional web site. Smaller banks with assets of less than € billion had an adoption rate of only 50%. The adoption of the Internet delivery channel by foreign bank subsidiaries is only marginally lower than that by Spanish banks (see Figure 1 and Table 1).

On line brokerage has become a more mainstream activity for retail banks and one of the main drivers used by European banks for acquiring new on-line customers and converting on-line existing off-line customers. Cost effectiveness seems to explain to a large extent this fact (McKinsey, 2001). On line brokerage activities are conducted

⁴ Only five banks declared not to offer any economic incentive to attract clients to use the Internet

directly in the bank, and hence the costs and benefits of conducting that business affect the bank's profitability. On-line brokers have undergone the most profound transformation due to the drastic cuts in brokerage costs brought about by the Internet. This in turn has allowed users to access much more information cheaply and respond more rapidly. Indeed, with very few exceptions, the large European banks with on-line presence offered trading services on their web site sites in 2000 (Moody's, 2000). In Spain, all large multichannel commercial banks offered on-line brokerage and trading and also all but one medium size bank offered this service in 2002. All large and medium size multichannel banks that offer this service are quoted on the stock market (Table 1). Finally, early adopters of the Internet delivery channel offered this service at the time of adoption.

This experience contrasts with the US, where online brokerage took off quite successfully, but via nonbank securities dealer firms; banks, for which the Gramm-Leach-Bliley Act of 1999 widens securities underwriting and dealing powers, nevertheless have to conduct those activities outside the bank, in a separate securities entity. So banks offering online brokerage are actually routing customers to a legally separate company within the holding company, and as a consequence the payoff does not really impact the bank.

3. Literature on the performance of multichannel banks

Studies on the impact of the Internet adoption on banks' performance, although scarce, are available for the US and European banking markets. In the US, Carlson *et al* (2000) and Furst, Lang and Nolle (2002) investigated whether there is a link between offering Internet banking and bank's profitability. To this end, the authors regressed ROE against a set of control variables for banks that adopted Internet as of Q3 1999. The authors conclude that Internet banking was too small a factor to have affected bank profitability at that time. This conclusion was in line with the previous findings of Egland *et al* (1998) who found no evidence of major differences in performance of Internet banks in the US. However, the authors express two caveats: Firstly, this result may not hold for all the banks and, secondly, they are open to change over time as the banks become more intensive in the use of the Internet. Sullivan (2000) also found no

channel.

systemic evidence that multichannel banks in the 10th Federal Reserve District were either helped or harmed by having transactional web sites. DeYoung, Lang and Nolle (2005) invoke the theoretical concepts of product and process innovation and develop numerous testable conjectures about the financial and strategic implications of Internet banking for U.S. community banks that adopted Internet prior to 1999, comparing their financial performance over 1999-2001 to the performance of traditional community banks. Their results show that multichannel banks are somewhat more profitable, chiefly via increased non-interest income from deposit service charges. DeYoung (2005) identifies and estimates the magnitude of technology based scale and technology based learning effects of a dozen of primarily Internet banks in the US over the 1997-2001 period. This author finds evidence of technology-based scale economies while the evidence on experience effects is rather weak. The empirical analysis demonstrates that profitability gaps with traditional banks of similar size and age shrink as primarily Internet banks get larger.

In Europe, most of the studies focus on the performance of primarily Internet banks: those that most heavily, although not exclusively, rely on Internet as a delivery channel. Delgado and Nieto (2004) studied the performance of these institutions in Spain and conclude that their profitability is negative due to higher financial costs and lower fee income, which seemed to reflect the fierce competition among Internet banks and between them and traditional banks in Spain. Delgado, Hernando and Nieto (2005) identify and estimate the magnitude of technology based scale and technology based learning economies of fifteen European primarily Internet banks. They conclude that these banks show strong evidence of technology based scale economies and their primary source seems to be the ability of primarily Internet banks to control operational expenses even more efficiently than the new traditional banks.

Although primarily Internet banks have focused the attention of most authors in Europe, the analysis of the performance of multichannel commercial banks as compared to traditional banks has been the objective of Hasan, Zazzara and Ciciretti (2005). The authors conclude that banks operating in Italy show a positive relationship between Internet adoption and profitability (ROA, ROE) over the 1993-2001 period.

The evidence of the impact of the adoption of Internet as a delivery channel on financial performance is mixed at both sides of the Atlantic. Nevertheless, the latest studies seem to find a positive relationship with profitability. It could be argued that as the intensity in the usage of Internet increases, the financial performance of multichannel banks is likely to improve. Our paper analyzes the impact of the transactional web adoption on commercial banks profitability in Spain after six, twelve and eighteen months since adoption. We also analyze the sources of the profitability gap and, more precisely, intermediation margin, securities brokerage fees, overhead, staff, IT and marketing expenses over the same time windows.

4. Data and financial analysis of Spanish multi channel banks

4.1 The data

The paper uses half yearly (annualized) data from the regulatory data base of Banco de España from the first half year of 1994 to the first half of 2002 as well as public data available at Datastream. It also draws from a voluntary survey carried out by Banco de España on Internet adoption of all deposit institutions operating in Spain. We have also used additional information from the individual banks web sites.

The database includes 72 separately chartered individual (non-consolidated) banks operating in Spain in 2002 (47 are Spanish banks and 25 are subsidiaries of foreign banks). The study excludes 17 very small banks that do not take deposits and/or they are specialised institutions part of a financial group. Bank mergers have been taken into consideration in the data collection process.

We focus on three samples of banks: Banks without a transactional web site, which may or may not have an informational web site (*traditional banks*); banks with transactional web sites (*multichannel banks*) and a subset of these multichannel banks that offer on-line brokerage and trading (*on-line brokers*).

The combined data set is an unbalanced panel of 1153 observations of 72 banks, over a nine year period starting in 1994. The data panel is unbalanced because four banks started operations after the first half year of 1994. In 2002, the average number of years

since adoption of the Internet as a delivery channel was three and a half years and around three years since adoption of on-line brokerage.

4.2 Financial analysis of the data:

Several financial performance ratios are used to analyze these three groups of banks. The financial ratios measure business activity as a percentage of total assets (loans, deposits, off-balance sheet and trading portfolio activity); operational performance as a percentage of average total assets (general expenses and more specifically staff, information technology and marketing costs), profitability (return on equity -ROE-, return on assets -ROA-, intermediation margin, other income and securities brokerage commissions,) and overall risk profile (Pearson coefficient of the stock return⁵) See Annex for definitions of variables.

Traditional versus Multichannel banks

Table 2 shows means and medians of the financial ratios as well as the statistical significance of the differences in these ratios between *traditional banks (without transactional web site)* and *multichannel banks (with transactional web site)*. The performance of *multichannel banks* is better in terms of ROE, although there are not clear differences in terms of ROA. This may be also explained by the differences in financial leverage. *Multichannel banks* generate more typical banking business (lending, deposit taking and securities trading -banks' own portfolio-). They have also a larger branch and ATM network. This seems to imply that, so far, the Internet channel has not substituted the more traditional delivery channels. In spite of the higher overall profitability, the intermediation margin of *Multichannel banks* is lower as they operate in a more competitive market, this result being statistically significant in terms of average and median. *Multichannel banks* do also engage in more off balance sheet activities which, in turn, seems to explain their higher other net income, being these results statistically significant only in terms of median. In addition to the higher commission income (other income net), the overall higher profitability of *multichannel banks* also seems to be explained by the somewhat lower general expenses and, more specifically, staff costs, all of which, in spite of having a larger branch and ATM network that handles a lower volume of total assets per branch and ATMs. The *Multichannel banks* show higher IT expenses, which are statistically significant both in

terms of average and median, while the differences in marketing expenses are not significant in absolute value.

The stock market perception of the differences in the overall risk profile, measured in terms of the Pearson coefficient (standard deviation divided by the average stock market quotation) shows no statistically significant differences between the two groups.

Multichannel banks versus on-line brokers

Table 3 shows, means and medians of the financial ratios as well as the statistical significance of the differences in these ratios between *multichannel banks* and *online brokers*. The performance of *online brokers* is better in terms of ROE. The *online brokers* generate somewhat lower typical banking lending business, while the differences in the off-balance sheet activities are not statistically significant. In spite of which, their asset size as well as branch and ATM network are even larger than those of the multichannel banks that have not adopted this business model. These results are statistically significant in terms of average and median. Also, *online brokers* engage in significantly more securities trading (own portfolio), although this result is only statistically significant in terms of average. *Online brokers* gain higher commissions (other income net) and, more specifically, securities brokerage commissions. However, *on-line brokers* have a somewhat narrower intermediation margin statistically significant only in terms of median. Regarding the cost structure, although *online brokers'* general expenses are somewhat lower, this difference is only statistically significant in terms of median. By components, none of the differences in staff, IT and marketing costs are statistically significant. The differences in terms of the overall risk profile measured in terms of the Pearson coefficient are not statistically significant.

Table 4 shows the *performance ratios growth of multichannel banks* (medians), from the inception to year 4 since adoption of Internet as delivery channel. Since most commercial banks have adopted Internet in late 90s, the number of banks decreases as the number of years since adoption increases so that after 5 years the number of institutions goes down considerably. For that reason the analysis focuses on the first four years since adoption. The number of branches and ATMs of *Multi channel banks*

⁵ Only 17 banks are quoted in the stock market and all but one has transactional web sites.

have continued increasing every year since Internet adoption, which seems to confirm the view that the Internet is an additional delivery channel and it has not substituted the traditional channels as yet. The total assets managed by the traditional distribution channels (branches plus ATMs) have been constantly increasing since Internet adoption, which may be at least partly explained by the utilization of the Internet as an additional business channel. Also, the off-balance sheet activities over total assets have increased in a consistent fashion since the first year of adoption. The impact of the Internet on profitability is mixed. The impact on ROE is positive after the second year of adoption. Moreover, multichannel banks have improved this ratio in almost a linear fashion after that year. However, the adoption of the Internet has a negative impact on ROA after the second year. The high competition is reflected in the negative and decreasing intermediation margin over the four year period being the decrease more important in the second year after adoption. The commissions' income (other income net) does increase in the first two years and turn negative afterwards, which may also reflect high competition. The general expenses and, in particular the staff costs, show a decreasing pattern throughout, while IT costs do only increase the first two years after adoption. Marketing expenses do not show any significant change over the four year period since adoption of the Internet as a delivery channel.

The univariate results shown above provide only a preliminary picture of the impact of the Internet adoption and on-line brokerage on the performance of multichannel banks in Spain. However, that impact is best represented by the estimated coefficients in the multivariate analysis below since the regressions control for other effects.

5. Regression analysis

The multivariate analysis explores the impact of the Internet adoption as well as the adoption of on-line brokerage as a business model on different performance variables. More precisely, this multivariate analysis consists of two set of regressions, in which some performance variables are regressed over dummies denoting the introduction of Internet as a delivery channel and a set of control variables. The first set of regressions is run for the whole sample of banks and includes dummy variables related to the period of introduction of a transactional web site. The second set of regressions is run for the sample of multichannel banks and includes dummy variables related to the period of

introduction of on-line brokerage. The coefficient associated with these dummies will indicate the possible association between adoption by banks (*Multichannel* or *On-line broker*) and their overall performance.

The equations considered are the following:

$$\begin{aligned} \text{PERFORMANC } E_{i,t} = & \alpha + \beta_1 * \text{MULTICHANN } EL1_{i,t} + \beta_2 * \text{MULTICHANN } EL2_{i,t} + \\ & \beta_3 * \text{MULTICHANN } EL3_{i,t} + \sum_K \delta_K * X_{it}^K + \sum_{t=1}^{17} \theta_t * \text{timedum}_t + \mu_i + \varepsilon_{i,t} \end{aligned} \quad (1)$$

$$\begin{aligned} \text{PERFORMANC } E_{i,t} = & \alpha + \beta_1 * \text{ONLINEBROK } ER1_{i,t} + \beta_2 * \text{ONLINEBROK } ER2_{i,t} + \\ & \beta_3 * \text{ONLINEBROK } ER3_{i,t} + \sum_K \delta_K * X_{it}^K + \sum_{t=1}^{17} \theta_t * \text{timedum}_t + \mu_i + \varepsilon_{i,t} \end{aligned} \quad (2)$$

where subscripts i and t index banks and time in semesters, respectively.

PERFORMANCE can be any of the following performance ratios. As operational performance ratio we have considered: general expenses over total average assets (*GEXP*), and more specifically, staff (*STAFF*), information technology (*IT*) and marketing (*MARK*) costs over total average assets). As profitability ratios we consider return on equity (*ROE*), return on assets (*ROA*), intermediation margin (*MINT*), other income (*OTHER_INCOME*)- and securities brokerage commission income (*COMINC*) over total average assets) and to measure overall risk profile we considered the Pearson coefficient of stock returns (*PEARSON*). We also include the variable *BRANCHES* as a dependent variable in order to analyze whether Internet web sites are substitutes for physical branches.

MULTICHANNEL1 is a dummy variable that equals 1 if the bank introduced a transactional web site the previous semester. *MULTICHANNEL2* is a dummy variable that equals 1 if the bank introduced a transactional web site the semester previous to the last and *MULTICHANNEL3* is a dummy variable that equals 1 if the bank is operating a transactional web site since at least 3 semesters.

Similarly, *ONLINEBROKER1* is a dummy variable that equals 1 if the bank introduced on-line brokerage the previous semester. *ONLINEBROKER2* is a dummy variable that equals 1 if the bank introduced on-line brokerage the semester previous to the last and *ONLINEBROKER3* is a dummy variable that equals 1 if the bank is conducting on-line brokerage since at least 3 semesters.

The coefficients of these dummies will reflect the time profile of the impact of Internet adoption (either transactional web site or on-line brokerage) on performance.

Both sets of regressions include a number of variables to control for differences in asset size, business and organizational structure as well as for the impact of the business cycle. In particular, the control variables (X) included are the following: off balance sheet accounts to total assets (OFF_BS), loans to total assets ($LOANS$), deposits to total assets ($DEPOSITS$), securities trading portfolio to total assets ($TRADEPORT$), total assets over branches⁶ ($BRANCHES$)- and the share of non-performing loans over total loans ($NPLOANS$). These variables are included with one semester lag (i.e. they are measured at the beginning of the period) in order to avoid potential endogeneity. The regression includes a dummy variable ($SUBSIDIARY$) that equals to 1 for banks that are subsidiaries of a banking group to control for organization structure and a dummy variable ($LARGE$) that equals 1 if total assets are above €9 billion and 0 otherwise to control for asset size. Finally, the regression also includes a set of dummy variables ($\sum_{t=1}^{t=17} timedum_t$) for each sample half year to control for the effect of macroeconomic variables over the sample period.

The regressions are estimated using a GLS-RE estimation technique. This approach includes, in addition to the usual random disturbance term (ε), a bank-specific disturbance component (μ) that accounts for unexplained variation in the dependent variable that it is specific to bank i during the sample period.

5.1 Results

Multichannel banks and Traditional banks

Regression results on the impact of the adoption of a transactional web site are shown in Table 5⁷. The adoption of the Internet as a delivery channel has a positive impact on *Multichannel banks'* profitability measured both in terms of ROA and ROE . This impact (3.2 p.p. in terms of ROE and 1.1 p.p. in terms of ROA) becomes significant **one and a half years after adoption**. Strong competition among multichannel banks as well as these and the traditional banks is reflected in the lower intermediation margin ($MINT$) (-0.19 p.p.) of *Multichannel banks* after 18 months of adoption, although the effect is not

⁶ The variable $BRANCHES$ is chosen over Automated Teller Machines (ATMs) for two main reasons: (a) both are highly correlated ($r = 0.94$) and (b) ATMs are mainly cash handling outlets in Spain.

⁷ As a robustness check, equations (1) and (2) have also been estimated with a sample that excludes primarily Internet banks, all of which are also recently established banks. The results obtained excluding those four banks are qualitatively similar to those reported in Tables 5 and 6. If anything, the impact on marketing expenses of the introduction of a transactional web site is weaker once those banks are excluded, what suggests that the induced increase in marketing expenses is larger for primarily Internet banks.

statistically significant. The differences observed in terms of higher commission income (*OTHER_INCOME*) in the univariate analysis disappear when using the above described control variables. However, results suggest that multichannel banks obtain higher brokerage commission income (*COMINC*).

The regression results confirm those obtained in the descriptive analysis in terms of the cost structure. *Multichannel banks* show statistically significant lower general expenses (*GEXP*) (- 0.80 p.p.) than traditional banks after eighteen months of adoption, in spite of the fact that the adoption of Internet increases these general expenses in the first six months after adoption (0.46 p.p.), although this short-term effect is not statistically significant. The positive impact of Internet adoption on general expenses is at least partly explained by the lower staff cost (-0.41 p.p.), which is statistically significant after a year and a half. As it would be expected, the introduction of a new technology goes hand in hand with higher IT expenditures during the first year (0.09 p.p. at six and 0.02 p.p. at twelve months since adoption), although this impact is not significant. Also, the introduction of a new delivery channel seems to involve higher marketing expenditures in the first semester after adoption (0.23 p.p.). Those expenditures aim at capturing new customers or transforming the customers using traditional channel into on-line customers. The results indicate that the increase in marketing expenditures is of a transitory character.

The dummy variables related to the period of introduction of a transactional web site are not significant in the branches equation, which suggests that the Internet is used as a complementary means of transacting rather than a substitute for the traditional distribution channels (branches or ATMs). Finally, the regression analysis confirms the results of the univariate analysis in terms of the non-statistically significant impact of the Internet as a delivery channel on the market perception of the overall risk profile of these banks (*PEARSON*).

Multichannel banks and on-line brokers

Regression results on the impact of the introduction of brokerage on-line are displayed in Table 6⁸. The adoption of the business model of *brokers on-line* does not seem to significantly affect the profitability of multichannel banks. In particular, the dummies

⁸ These results should be taken with some caution due to the small sample size.

associated to the introduction of on-line brokerage turn out to be non-significant in the equations for *ROE*, *ROA*, *MINT*, *COMINC* and *OTHER_INCOME*. Thus, some of the differences in these variables between multichannel banks using or not on-line brokerage that were observed in the univariate analysis disappear when using the above described control variables.

In terms of the cost structure, the introduction of the on-line brokerage business model is associated with higher overhead expenses (*GEXP*) within the first semester after the adoption of the new business line. This effect is transitory and it is mainly explained by the increase in expenses on information technologies (*IT*). In both cases the effect is only significant in the first six months..By contrast, *brokers on-line* have higher personnel expenses (*STAFF*) (0.14 p.p.) than multichannel banks after eighteen months of adoption of the business model, which seems to reflect the need for higher skilled labour. However, no statistically significant differences in marketing expenditures (*MARK*) can be observed between the two groups of banks.

As it was the case with the introduction of a transactional web site, the adoption of the on-line brokerage business model does not significantly affect the ratio of total assets over total number of branches. Finally, the stock market does not perceive any statistically significant difference in terms of overall risk profile between the two groups of banks as measured by *PEARSON*.

6. Conclusions

Spanish banks' strategy has been in line with the current world wide trends according to which the multichannel ("clicks and mortar") banks will prevail, at least in the medium term. Adoptions started in the second part of the 90's and by the turn of the century more than half of the banks operating in Spain have transactional web sites and forty three percent were active brokers on line.

In Spain, the adoption rates and distribution by size are comparable to the banks in the US. The characterization of the multichannel banks was as follows in 2002: All large and all but one medium size banks have adopted a multichannel strategy; all of them are publicly quoted in the stock market. However, adoption of the Internet as a delivery channel was lower in the case of the small banks barely reaching fifty percent. Early adopters of the Internet delivery channel offered on-line brokerage and trading at the

time of adoption (all large multichannel commercial banks offered on-line brokerage and trading and also all but one medium size bank offered this service). All large and medium size multichannel banks that offer this service are quoted in the stock market.

In spite of the conspicuous use of this new delivery channel, there are few studies worldwide on the impact of the Internet on performance and overall risk profile and none of banks operating in Spain. The purpose of this paper has been to identify and estimate the impact of the Internet on banks' operational performance and overall risk profile. To this end, this paper presents a multivariate analysis to estimate the impact on performance of the introduction of a transactional web site and of the adoption of on-line brokerage. The main conclusions of this analysis are as follows:

- The Internet delivery channel serves as complementary mean of transacting with customers rather than a substitute for physical branches. Despite the large investment in the Internet as a channel of distribution, the branch network remains an important channel for retail banking products in Spain.
- The impact on performance of adoption of the Internet as a delivery channel or the broker on line business model varies over time.
- The adoption of a transactional web site has a positive impact on profitability. This impact, that becomes significant one and a half years after adoption, is observed both in terms of *ROE* (3.18 p.p.) and *ROA* (1.14 p.p.). This improvement in profitability is also reflected in higher brokerage commission income. However, no significant differences in profitability associated to the introduction of on-line brokerage are observed
- The profitability gains associated with the adoption of a transactional web site are mainly explained by a significant reduction in overhead expenses (0.80 p.p.), and in particular in staff costs (0.41 p.p.), eighteen months after adoption. By contrast, the introduction of on-line brokerage induces, after one and a half years, an increase in staff costs (0.14 p.p.). On a more short-term basis, the adoption of a transactional web site increases marketing expenses (0.23 p.p.) within the first semester after adoption. Similarly, the adoption of on-line

brokerage also generates a short-term increase in information technology costs (0.16 p.p.)

- The adoption of the Internet delivery channel does not significantly affect the overall risk profile measured in terms of the Pearson Coefficient of the stock price.

The above results in terms of profitability are in line with those obtained by DeYoung, Lang and Nolle (2005) in the US and Hasan, Zazzara and Ciciretti (2005) in Italy. Our analysis shows also that this effect varies over time and explains in terms of cost and income structure the main drivers of the better performance. Nonetheless, our results should be taken with caution since they do not take into consideration the intensity in the use of the Internet as a delivery channel (or the intensity in the adoption of the broker on line business model). Moreover, any further deepening of the analysis of the impact on performance of the adoption of Internet banking (broker on line) would benefit from accounting systems that discriminate financial variables per delivery channel and business line.

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8. Annex: Definition of Variables

Loans: Total loans and credits over total assets at the end of period

Off-balance sheet (*OFF_BS*): Contingent assets and liabilities over total assets at the end of period

Deposits: Current accounts and term deposits over total assets at the end of period

Trade portfolio (*TRADE_PORT*): Banks' own trading portfolio over total assets at the end of period

Non performing loans (*NPL*): Non performing loans (doubtful and overdue) over total assets at the end of period

Branches: Total assets over total number of branches at the end of period

ROA: Gross profits over average assets of beginning and end period

ROE: Gross profits over average equity of beginning and end period

Mint: Net interest margin and dividends over average assets of beginning and end period

Other income: Net commission income plus net profits (losses) of sales of the bank's own trade portfolio over average assets of beginning and end period

Cominc: Brokerage commissions over average assets of beginning and end period

Gexp: Total overhead expenditures over average assets of beginning and end period

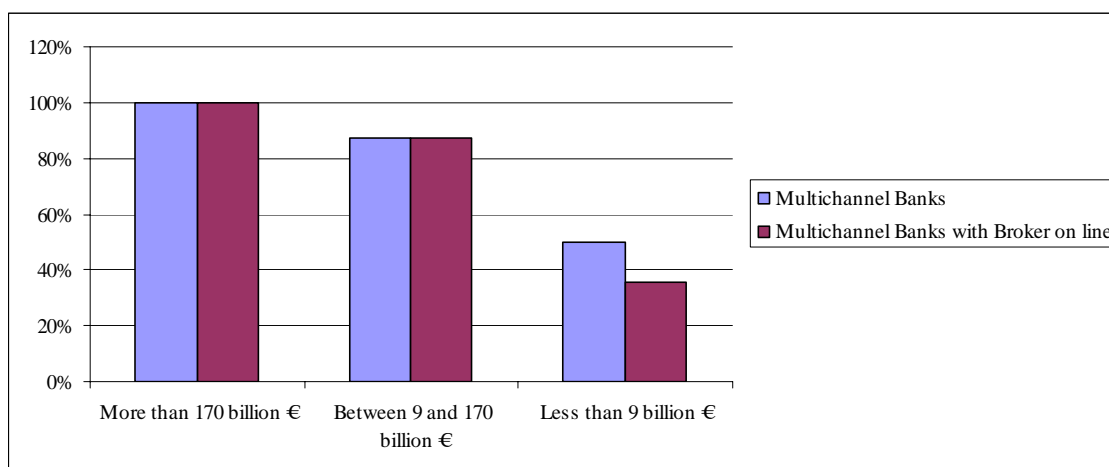
Staff: Personnel expenditures over average assets of beginning and end period

IT: Expenditures on Information Technology (i.e. software research and development expenses, amortisation of purchased software, data processing) over average assets of beginning and end period

Mark: Expenditures on marketing over average assets of beginning and end period

Pearson Coefficient: Standard deviation of the stock market return over the average market return of end of period.

Figure 1: Multichannel banks and banks with broker on line by asset size in Spain (2002)



Source: Banco de España

Table 1: Characteristics of the multi channel banks in Spain (2002)

		Number	No Web	Informational Web	Transational Web	On-line brokerage and Trading
Banks		72	17	55	40	31
Large		2	0	2	2	2
	<i>Quoted</i>	2	0	2	2	2
Medium		8	0	8	7	7
	<i>Quoted</i>	6	0	6	6	6
Small		62	17	45	31	22
	<i>Quoted</i>	9	0	9	8	7
<i>Additional Information</i>						
<i>Part of Financial Group</i>						
Independent		9	3	12	8	3
Part of Financial Group		63	14	43	32	28
<i>Ownership</i>						
Spanish Institution		47	10	37	28	24
Subsidiaries Foreign Bank		25	7	18	12	7

"Quoted" in the stock market

Source: Banco de España

Table 2: Summary statistics (1994-2002): Traditional Banks and Multichannel Banks

	Without Transactional Web		With Transactional Web		Test on Means	Test on Medians
	Mean	Median	Mean	Median		
Total Assets (TA)	3502222	584093.5	19100000	3081678	0.00	0.00
Branches	111.24	10.50	494.95	162.00	0.00	0.00
Loans / TA	37.13	36.83	53.98	54.58	0.00	0.00
Deposits / TA	33.10	31.91	44.99	46.73	0.00	0.00
Off balance Sheet / TA	22.71	15.75	24.51	24.93	0.40	0.00
Trading Portfolio / TA	1.08	0.00	1.53	0.01	0.11	0.00
TA / Branches	302432	31118.50	129156	28038.50	0.02	0.43
Fin. Intermediaries / TA	39.40	32.33	25.63	19.64	0.00	0.00
ATMs	85.92	2.00	548.54	128.50	0.00	0.00
TA / ATMs	161224	31252.63	96726	29851.47	0.42	0.94
TA /(Branches+ ATMs)	217402.40	19340.57	86480.88	14464.32	0.10	0.05
Pearson Coefficient	0.06	0.04	0.06	0.05	0.93	0.46
St. Dev. Stock return	39.44	10.47	56.10	36.50	0.18	0.00
ROA	1.25	0.84	0.51	0.88	0.04	0.49
ROE	10.91	8.23	14.67	17.05	0.00	0.00
Intermediation Margin / TAA	3.17	2.79	2.63	2.49	0.00	0.05
Other Income (net) / TAA	1.11	0.81	1.24	1.07	0.27	0.00
General Expenses / TAA	-3.01	-2.77	-3.06	-2.46	0.84	0.00
Staff Costs / TAA	-1.60	-1.58	-1.53	-1.47	0.40	0.00
IT costs / TAA	-0.27	-0.19	-0.35	-0.22	0.03	0.00
Marketing Expenses / TAA	-0.16	-0.04	-0.23	-0.04	0.41	0.00
Securities brokerage commissions/TAA	0.15	0.01	0.13	0.03	0.67	0.00

Table 3: Summary statistics (1994-2002): Multichannel banks and on-line brokers

Summary Statistics (1994-2002) Number of Observations = 297						
	With Transactional Web		Brokerage on line		Test on Means	Test on Medians
	Mean	Median	Mean	Median		
Total Assets (TA)	9724916	1632273	24100000	4570314	0.01	0.00
Branches	245.91	76.00	623.99	199.00	0.00	0.00
Loans / TA	57.00	61.67	52.37	53.02	0.11	0.03
Deposits / TA	42.23	43.29	46.46	47.80	0.08	0.35
Off balance Sheet / TA	23.19	24.07	25.21	24.96	0.23	0.72
Trading Portfolio / TA	1.05	0.00	1.78	0.03	0.10	0.15
TA / Branches	113397.40	19525.00	137363.20	30304.00	0.62	0.18
Fin. Intermediaries / TA	24.84	17.07	26.04	21.69	0.64	0.10
ATMs	229.10	73.00	715.20	145.50	0.02	0.00
TA / ATMs	121626.30	29081.47	83653.04	29851.47	0.49	0.85
TA /(Branches+ ATMs)	51224.22	10983.24	105077.80	16340.00	0.30	0.64
Pearson Coefficient	0.06	0.07	0.06	0.05	0.45	0.49
St. Dev. Stock return	25.45	15.65	63.41	42.38	0.04	0.01
ROA	0.24	0.83	0.66	0.91	0.38	0.35
ROE	11.48	12.15	16.37	19.57	0.04	0.00
Intermediation Margin / TAA	2.67	2.86	2.61	2.16	0.72	0.03
Other Income (net) / TAA	0.90	0.92	1.42	1.29	0.03	0.00
General Expenses / TAA	-3.14	-2.61	-3.02	-2.39	0.77	0.04
Staff Costs / TAA	-1.49	-1.50	-1.55	-1.45	0.73	0.60
IT costs / TAA	-0.34	-0.24	-0.36	-0.22	0.72	0.19
Marketing Expenses / TAA	-0.23	-0.05	-0.23	-0.04	0.95	0.08
Securities brokerage commissions/TAA	0.07	0.02	0.17	0.03	0.09	0.03

**Table 4: Median Performance growth (%) since year of adoption of Internet:
Multi channel banks**

	Banks: Time in years since Internet adoption			
	1 year (N=39)	2 years (N=33)	3 years (N=28)	4 years (N=26)
Total Assets (TA)	0.07	0.18	0.32	0.44
Branches	0.00	0.02	0.03	0.05
Loans / TA	3.75	9.01	11.18	14.41
Deposits / TA	2.27	8.62	10.13	6.70
Off balance sheet / TA	2.25	3.84	4.48	6.08
Trading Portfolio. / TA	0.00	0.00	0.00	0.00
Financial Int. / TA	-3.10	-7.13	-9.11	-9.41
ATMs	0.14	0.32	0.43	0.49
TA / (branches+ATMs)	0.02	0.05	0.14	0.19
Pearson Coeff.	-0.04	-0.05	-0.05	-0.06
Standard Dev. Stock Return	-9.38	-11.75	-8.76	-10.47
ROA	0.04	-0.07	-0.03	-0.05
ROE	-0.55	0.11	1.40	2.10
M. Intermediation / TAA	-0.12	-0.27	-0.25	-0.30
Other Income (net) / TAA	0.03	0.03	-0.03	-0.08
General expenses / TAA	-0.08	-0.21	-0.37	-0.55
Staff costs / TAA	-0.08	-0.16	-0.23	-0.36
IT costs / TAA	0.01	0.01	-0.03	-0.03
Marketing expenses / TAA	-0.01	-0.01	-0.01	-0.01
Brokerage commission income/TAA ^A	0.00	0.01	0.01	0.00

Note: Change in ratio from date of adoption of Internet with the exception of total assets; branches; ATMs, total assets / ATMs and total assets /ATMs and branches that show rate of increase

Table 5: Regression Analysis (1994-2002): Multichannel banks and Traditional banks

	roe	roa	mint	cominc	other income	gexp	staff	it	mark	branches	Pearson coef.
multichannel1	0.032	-0.577	0.004	0.084*	0.07	0.456	0.004	0.087	0.227*	-1.604	-0.005
multichannel2	0.223	0.586	-0.119	0.103**	0.106	-0.226	-0.156	0.015	-0.003	-1.823	0.006
multichannel3	3.184**	1.135**	-0.186	0.064*	-0.036	-0.799***	-0.406***	-0.072	-0.112	-1.033	0.012
subsidiary	1.411	-0.236	0.007	-0.128***	0.004	0.573*	0.527***	0.039	0.001	-1.907	-0.007
off_bs	0.027	0.014**	0.005	0.001	0.012***	0.001	0.001	0.001	-0.001	-0.203**	-0.001*
loans	0.079**	0.023**	0.013**	-0.001	-0.005*	-0.021***	-0.010***	-0.004***	-0.004**	-0.477**	0.001*
deposits	-0.089**	-0.002	0.005	0.002**	0.004	0.004	0.009***	0	-0.004**	-0.204	0
trade_port	-0.097	-0.017	-0.028	-0.009***	0.021**	-0.005	-0.004	-0.003	-0.003	1.231*	0.001
npl	-0.484	-0.066	0.051	-0.007	-0.066**	0.002	0.007	-0.004	-0.018	0.763	0.002
branches	0.008	0.004*	-0.001	0	-0.001	-0.004***	-0.002***	-0.001***	-0.001**		0.003
large	6.427*	-0.237	-0.151	-0.069	-0.069	0.062	0.131	-0.001	0	22.288	0.016*
Constant	9.477***	0.045	2.969***	0.183**	0.874***	4.118***	1.521***	0.496***	0.805***	41.230***	0.017
Observations	919	919	919	919	919	919	919	919	919	921	216

Absolute value of t statistics in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 6: Regression Analysis (1994-2002): Multichannel banks and on-line brokers

	roe	roa	mint	cominc	other income	gexp	staff	it	mark	branches	Pearson Coef.
onlinebroker1	-2.418	-0.541	-0.041	0.005	0.05	0.420*	0.081	0.159**	0.092	-4.822	0.001
onlinebroker2	-2.236	0.138	-0.07	0.006	0.011	-0.2	0.003	-0.09	0.004	2.239	0.006
onlinebroker3	-1.194	0.109	-0.008	0.032	0.098	0.164	0.140*	-0.007	0.043	-0.844	-0.002
subsidiary	-1.068	-0.077	0.277	0.039	0.204	0.403	0.11	0.068	0.141	2.467	-0.025***
off_bs	0.295*	0.026*	-0.001	0	-0.001	-0.012	-0.002	-0.005*	-0.008***	-0.516*	0
loans	0.219**	0.027***	0.015***	-0.004***	0.001	-0.001	0.004*	-0.004***	-0.003	-1.434***	0.001***
deposits	0	0	0.006	0.001	0.003	0.016***	0.007***	0.002	0.004**	0.490***	0
trade_port	0.175	0.006	-0.002	-0.001	-0.003	-0.013	-0.007	-0.005	-0.002	-0.875*	0.001
npl	2.579	0.274	0.121	0.069**	0.017	0.005	0.065	-0.026	-0.118*	9.954	0.005
branches	0.157***	0.016***	-0.001	-0.001***	-0.001	-0.018***	-0.005***	-0.004***	-0.005***		0.002
large	8.920*	0.255	0.009	-0.058	-0.066	-0.216	-0.037	-0.078	-0.025	-5.487	0.003
Constant	-2.054	-1.448	1.610***	0.209*	0.804***	2.299***	1.114***	0.580***	0.35	63.761***	0.004
Observations	175	175	175	175	175	175	175	175	175	175	90

Absolute value of t statistics in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%