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## **EFFECT OF INNOVATION ON AIRLINES' OPERATING LEVERAGE: A SPANISH CASE STUDY**

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### **ABSTRACT**

This article assesses potential variations in the risk to an airline's market value resulting from incurring high investments in innovations. This can be important for airlines, whose large fixed costs and high operational leverage make their commercial viability heavily dependent on revenue flows. An empirical application in Spain shows that innovations lead to an increase in an airline's risk, via volatility, but this variation is not the same for all types of innovation: advanced consumer segmentation innovations are found to have a greater impact on sales than on fixed costs.

**Key words:** innovation; firm value; airlines; operating leverage.

### **1. INTRODUCTION**

Airlines have seen the recent collapse of a number of new and established carriers, such as Spanair or Malev, as well as a new wave of mergers. Both macro and micro factors have been causal factors in this trend, including bank credit restrictions, economic recession, and volatile oil prices. While airlines generally reacted quickly to the post 2008 global economic downturn in demand by adjusting their capacities and costs, recovery in profits has been slow for many (Franke and John, 2011).

Innovation can make differences on both the demand and cost sides of any business, including airlines operations, by helping them maintain their competitive edge. In this context, Franke (2007) defines three types of innovation that airlines have been using to strengthen their competitive edge:

- New business models, which emerge as a reaction to the advent of low-cost carriers and new intercontinental carriers, or as a consequence of the necessary realignment of resources after consolidation. For example, in 2005 Iberia set up a new system of yield management to compete against low-cost carriers to counteract the impacts of the latter in domestic and European markets.
- Advanced customer segmentation, which are designed to adapt an airline's offers of service to meet current customer requirements. The increased sophistication of modern yield management techniques allows almost the tailoring of personalized service for each client as customers expect to be treated individually. This approach attaches more importance to the identification of individual preferences, and has become important in Customer Relationship Management.

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- New technologies, which seek more efficient customer interaction (e.g. Iberia’s introduction of a new information system to inform passenger of flight arrivals through their cell phones) or more efficient operations (e.g. Iberia initiative in 2001, along with Amadeus, of creating “Savia Tours”: an electronic reservation system making for easier interaction between airlines and tour operators).

## 2. INNOVATIONS AND RISK

The adoption of new inventions or measures of innovation often involve large investments and concomitant financial risk, and this can be a particular problem for low margin, heavily leveraged companies that is typically the case with airlines (Guzhva and Pagiavlas, 2003). Building on Hazledine’s argument (2011) that fixed costs can affect an airline’s market value, we assess the variation in the risk of an airline’s market value resulting from investments in innovations.

Conceptually, it is possible to relate variations in an airline’s risk associated with adopting an innovation to changes in its operating leverage using the fixed-variable cost ratio<sup>1</sup>. Operating leverage represents the sensitivity of profits to changes in sales (Bernstein, 1993), in such a way that highly leveraged firms, once they reach a break-even point, will enjoy an increase in profits as a result of variations in turnover<sup>2</sup>. This issue is especially relevant when carrying out investments with high fixed costs, since their amount makes the break-even point vary.

To examine the impact on operating leverage let  $S$  be sales volume,  $PR$  profits,  $vc$  the proportion of variable costs on sales and  $FC$  fixed costs. Then, operating leverage  $OL$  is expressed as

$$OL = \frac{\partial PR}{\partial S} \frac{S}{PR} = \frac{\partial [S - vc \cdot S - FC]}{\partial S} \frac{S}{[S - vc \cdot S - FC]} = \frac{S - vc \cdot S}{S - vc \cdot S - FC}$$

We see that the final impact of a new investment will be contingent upon both the amount of its fixed costs and the increase in revenue. Taking  $x$  to be the amount of a given innovation investment, considering derivatives, we obtain

$$\frac{\partial OL}{\partial x} = \frac{1 - vc}{(S - vc \cdot S - FC)^2} \left\{ \frac{\partial FC}{\partial x} S - \frac{\partial S}{\partial x} FC \right\}$$

Thus, a new innovation investment will imply a reduction in operating leverage,  $\partial OL / \partial x < 0$ , when:

$$\frac{\partial FC / FC}{\partial x} < \frac{\partial S / S}{\partial x}$$

The final impact on operating leverage and, consequently, on the firm’s sensitivity therefore relies on the size of the relative variation in both sales volume and fixed costs.

## 3. METHODOLOGY

To examine the link between innovation and financial risk we use of data from Iberia Airlines, the leading Spanish airline traded on the Spanish Stock Market, and use the Factiva database to identify its innovation activities by looking for key words such as the “company name”, “innovation”, “innovate”, “novelty”, “new product”, “new

<sup>1</sup> From a practical point of view, Adler and Gellman (2012) argue that, because of increasing volatility in the economic performance of airlines, there is a need for stakeholders to have the right strategies for properly managing risk.

<sup>2</sup> There are cases where poorly designed leveraging strategies will have the reverse effects with profits declining.

service”, “new process”, “new procedure”, “new system”, and “new technology”. The event day is defined as the first day in which the news appears in any of the publications included in the database. The search found reference to 36 such innovations. Market performance deploys raw data on the daily value of Iberia shares from April 3, 2001 to 31 December 31, 2008, available from the stock market<sup>3</sup>.

The underlying model considers  $R_{it} = \alpha_i + \beta_i RM_t + \varepsilon_{it}$ , where  $R_{it}$  represents returns on firm share  $i$  on day  $t$  and  $RM_t$  is the rate of returns on the market portfolio on the same day  $t$ . The parameters  $\alpha_i$  and  $\beta_i$  represent the constant and the systematic risk on share  $i$ , and  $\varepsilon_{it}$  is the error term. Autoregressive conditional heteroskedasticity models are used for estimation. These permit the modelling of the conditional variance of returns. The best fitting model is the EGARCH (1,1), in which  $\varepsilon_{it} = h_{it}^{1/2} \eta_{it}$  and  $\varepsilon_{it}/\varepsilon_{it-1}, \varepsilon_{it-2}, \dots \sim N(0, h_{it})$ , being  $\eta_{it}$  independent and identically distributed, with  $E(\eta_{it})=0$  and  $E(\eta_{it}^2)=1$ , whose conditional variance  $h_{it}$  is

$$h_{it} = \exp \left\{ c_i + \lambda_{ij} \left| \frac{\varepsilon_{it-j}}{h_{it-j}^{1/2}} \right| + \delta_{ij} \frac{\varepsilon_{it-j}}{h_{it-j}^{1/2}} + \gamma_{ik} \ln(h_{it-k}) \right\}$$

where  $c_i$  is the autonomous coefficient of the conditional variance,  $\lambda_{ij}$  is the sensitivity of the conditional variance to the lagged error term,  $\delta_{ij}$  is the asymmetric effect on the conditional variance and  $\gamma_{ik}$  represents the sensitivity of the conditional variance to the lags of the conditional variance itself.

To detect risk variations in the market value, we define a binary variable  $D_{t+J}$  that takes the value of one during a  $J$ -day period following the innovation announcement day. It is included in the expression of the conditional variance ( $h_{it}$ ) in order to represent the sensitivity of the autonomous coefficient of the conditional variance in the time period considered; that is, the impact of an innovation announcement on the volatility of the airline’s returns can be determined by measuring the effect that this news item could generate on the average level of the conditional variance. To reflect the innovation type effect, three binary variables are created: new business models (NBM), advanced customer segmentation (ATS) and new technologies (NT), with NBM taken as the base reference. These variables are interacted with  $D_{t+J}$  to reflect the volatility change depending on each innovation type.

## §. RESULTS

To estimate the possible changes in risk volatility, the conditional variance of the model is specified as:

$$h_{it} = \exp \left\{ c_i + \xi_1 D_{t+2} + \xi_2 D_{t+J} ACS + \xi_3 D_{t+J} NT + \lambda_{ij} \left| \frac{\varepsilon_{it-j}}{h_{it-j}^{1/2}} \right| + \delta_{ij} \frac{\varepsilon_{it-j}}{h_{it-j}^{1/2}} + \gamma_{ik} \ln(h_{it-k}) \right\}$$

where  $D_{t+2}$  takes the value of one for the two days following the announcement day,  $\xi_1$  represents the sensitivity of the autonomous coefficient of the conditional variance in the period considered<sup>4</sup> and  $\xi_2$  and  $\xi_3$  are the innovation-type impact (ACS and NT) on volatility. The results are ( $t$ -statistics in parenthesis):

$$h_{it} = \exp \left\{ \begin{matrix} -0.626 & + & 0.276 & D_{t+2} & - & 0.352 & D_{t+J} & ACS & - & 0.144 & D_{t+J} & NT & + & 0.247 & \left| \frac{\varepsilon_{it-j}}{h_{it-j}^{1/2}} \right| & - & 0.014 & \frac{\varepsilon_{it-j}}{h_{it-j}^{1/2}} & + & 0.943 & \ln(h_{it-k}) \end{matrix} \right\}$$

(-12.15)
(3.19)
(-3.13)
(-1.12)
(13.58)
(-1.21)
(172.8)

<sup>3</sup> See Nicolau and Santa-María (2012) for more details

<sup>4</sup> Some news items were very close to each other in time, which prevented us from using longer windows.

We find a general increase in volatility after the innovation announcement has been released, but when this general effect is controlled by innovation type, we find that advanced consumer segmentation is perceived to be the least risky. The addition of the general (0.276) and ACS (-0.352) parameters results in a negative (-0.076) coefficient; thus, the expectations on future sales derived from ACS programs are higher than the increases in fixed costs required for such investments.

## **5. CONCLUSIONS**

This article shows that innovations bring about an increase in an airline's financial risks but this variation is not the same for all innovation types. We find that advanced consumer segmentation innovations are perceived as having a larger impact on sales than on fixed costs, leading to a reduction in the airline's business risk.

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