European Journal of Applied Business Management, 4(2), 2018, pp. 27-42.

EJABM European Journal of Applied Business and Management

ISSN 2183-5594

Research Paper

An application of lemon theory to the case of university spin-offs

Submitted in 24, January 2018
Accepted in 12, June 2018
Evaluated by a double blind review system

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Abstract

Purpose: Policies implemented by different government administrations to promote the transfer of research results have significantly increased the number of university spin-offs created and their survival rate. However, these companies are frequently perceived by investors as less market or commercial oriented than non-academic start-ups. This paper test this hypothesis and discusses in the framework of Akerlof ´s lemon market theory the implications of the evidence found for the growth, performance and capacity of attracting private investors to these companies.

Design: We analysed a sample of 20 USOs of the University of Santiago de Compostela, Spain, using their financial statements and the R&D grants received during their initial five years. We carried out an analysis of conglomerates to identify the market orientation of the USOs, and the moment when it is clearly developed.

Findings: Evidence shows that some of these companies appear to have been set up to provide continuity to research projects, rather than to exploit research results. In these companies most of the revenues are consistently mainly obtained by obtaining R&D public grants. This introduces "orientation risk" in addition to the common risks of start-ups in general.

Practical Implications: To solve this problem a series of measures used in other lemon market situations can be adapted to the university spin-offs issue. This includes the promotion of commercial activities over R&D grants and reducing agency problems between academic entrepreneurs and professional investors among others.

Original Value: We find that the market orientation of USOs cannot be identified in their earlier stages by conventional financial analysis and discuss the implications for attracting investors to these companies.

Keywords: lemon theory; university spin-offs; Akerlof; market orientation; agency problems

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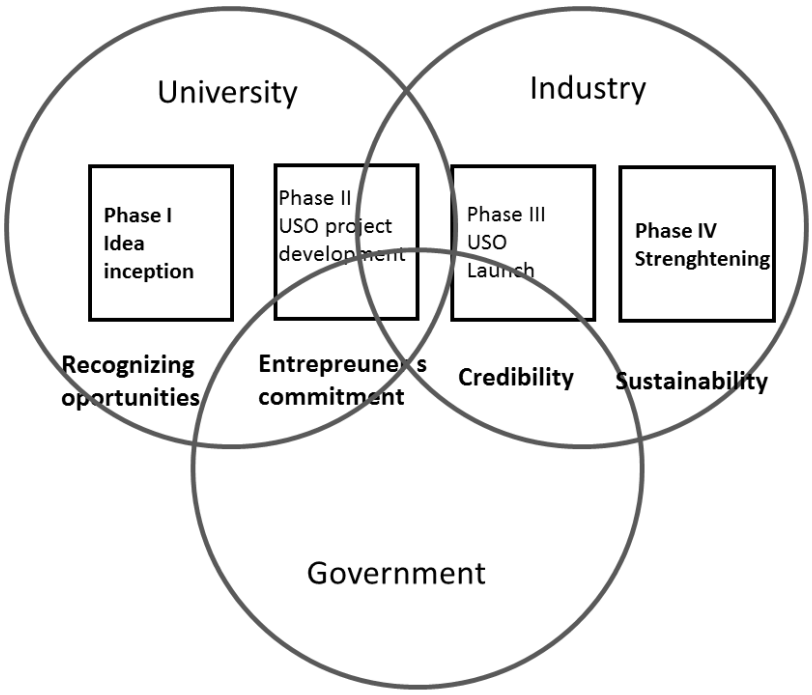
ISSN 2183-5594

1. Introduction

The emphasis in creating start-ups and technology companies in economic growth policies has increased over the last decades in almost all countries. Consequently, governments have developed numerous policies to facilitate the creation of innovative companies. At the same time, the role of universities in innovation systems is increasingly relevant. They are considered to be one of the most promising agents in developing knowledge and technologies that promote the development of the regions. One of the possible ways in which academic institutions can transfer their technology to society is the creation of university spin-offs (USO). Such companies may be considered as a specific category within start-ups, whose purpose is to commercially exploit the knowledge, technology and/or research results developed within universities.

In the creation and consolidation of these companies, different actors are involved, from the field of academia, the public and the private sector. Etzkowiz (2003) in his triple helix model highlights the need for the participation of these three agents. Meanwhile, in the Vohora et al. model (2004) the different stages through which the life of a spin-off passes are shown; from the generation of the idea to the consolidation of the company in the market. In Figure 1 we have fused these two models with the idea of showing the transition of a spin-off from its beginnings, when the role of the university is predominant, to the stage of development and growth, where purely business factors are relevant. Throughout most of this process it is considered that the government should act as a catalyst for this transition by encouraging both the development of innovations with commercial potential in the region "university" and the transfer of these innovations for commercial use in the region "industry".

Figure 1. Triple helix model (Etkovitz, 2003) combined with Vohora model (Vohora et al. 2004)



Font: Adapted from Etkovitz, (2003) and Vohora et al. (2004).

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ISSN 2183-5594

Theoretically the creation of USOs creates benefits for the university, the entrepreneurs themselves, and generally, for society (Bray and Lee, 2000). Entrepreneurs, usually researchers and highly qualified graduates, in university spin-offs have an opportunity to enter the labour market by creating their own company (Hernández et al., 2003) and thereby obtaining financial returns. For the university these companies can create economic returns and are a way to diversify their funding base. This is crucial today where revenues from tuition and government funding are shrinking. Universities can earn revenue through the sale of shares, by selling exclusive licensing contracts for the technology created within the institution or by contracting research groups, services or facilities. Finally, companies created from universities encourage the development of economies and their growth, especially in the geographical area where they are based (Zucker et al., 1998).

Therefore, all the agents involved in the triple helix can benefit from the creation and consolidation of the SOU. However, the incentives that drive each agent at different stages of the process does not always coincide, leading to conflicts because of the different perspectives of each group, making the viability of the project difficult. This peculiarity may be related to the limited participation of investors and industrial partners which has been observed in these types of projects (Ortin and Vendrell, 2010; Rodeiro et al. 2013). This requires a detailed analysis.

The inclusion of the private sector in these types of projects, both directly in the equity of companies and indirectly by establishing partnerships and trusting relationships with them, is key to its success. The direct involvement of the private sector is a Font of funding in the early stages, a key issue in these types of projects, since, due to their higher level of risk they have great difficulty accessing instruments traditionally employed such as bank loans. Moreover, the entry of investors of the "industry" region provides business experience, complementing the capabilities of the original entrepreneurial team, usually composed of highly specialized researchers in their area of expertise, but with little or no training in business and management aspects (Ortin et al ., 2007). One of the main forms of interaction between business and academic entrepreneurs is when the former acts as clients and for this to happen it is necessary that the business sector has a knowledge of these companies and of the products and services they offer and their market orientation. The inclusion of a sufficient level of market orientation in USOs has been identified as a key element in their performance (Migliori et al., 2017).

In Anglo-Saxon countries the interaction between academia and business has historically been strong and USOs activity there is consolidated today (Shane, 2004). In contrast to other European, Latin American or Asian countries, where the degree of integration is much lower. In many of these countries the governments and universities have established a series of actions to support the creation of USOs, including programs and subsidies for these companies trying to compensate for the lack of private investment. Such policies have led to increasing numbers of spin-offs created in universities throughout most of these countries as well as increasing the chances of survival of the projects already on the market.

Spain is a clear example of the situation described. The public administration has set a goal to promote the transfer of technology through USOs while universities have increased the number of entrepreneurial programs. As a result the number of spin-offs created in Spain has risen from 18 in 2000, to an average of over one hundred in the period 2006-2014, as shown in Figure 2 (Red OTRI, 2016).

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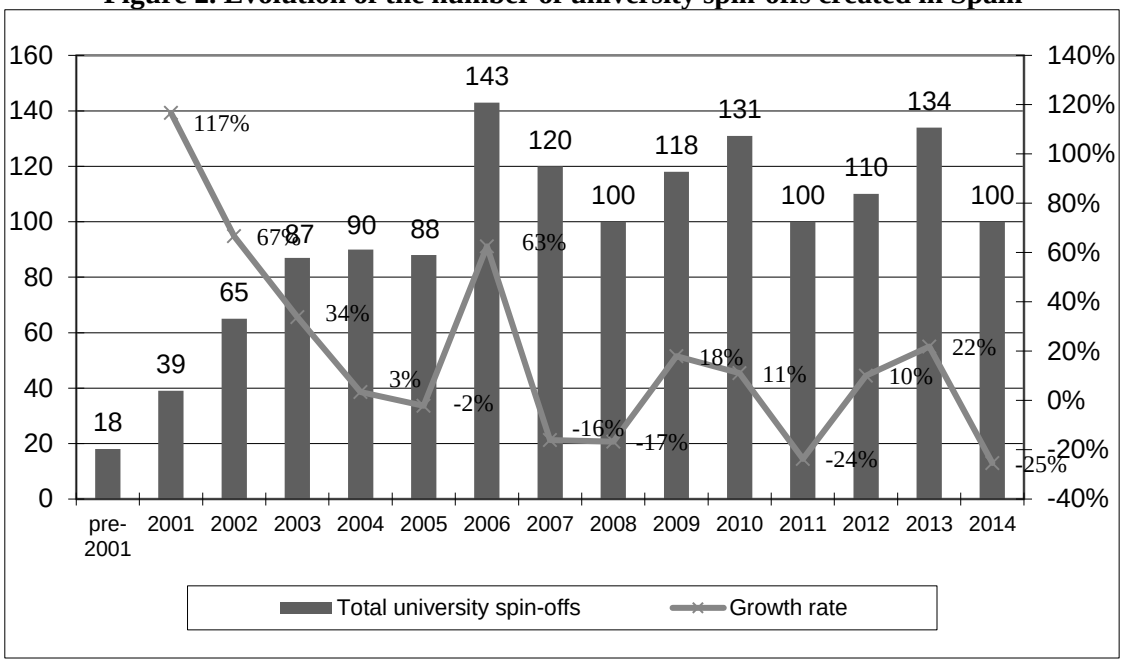
Figure 2. Evolution of the number of university spin-offs created in Spain



Font: Adapted from Red OTRI (2016).

However, in recent years a problem associated with the creation of USos has been identified on an international level. Recent studies indicate that perhaps the creation of spin-offs is not the most appropriate tool for the transfer of technology from the universities to society due to the low impact of these companies in the economy (Callan, 2001). The report Fostering Entrepreneurship (OECD, 1998) indicates that in many countries the USOs tend to remain relatively small in size without growth. Within the European Union most spin-offs do not have more than 10 employees after six years in existence (Mustar et al., 2007). According to Lester (2005), spin-offs are a very small percentage (2-3%) of the overall rate of new businesses. In the case of the U.S., Hughes (2007) suggests that there is an overemphasis on the spin-off model, which may reveal that decision makers do not adequately understand the nature of the technology transfer. In fact, Lambert (2003) shows that a large number of technology companies created in the UK will not succeed in the long term due to their low quality. Also, other papers such as Chiesa and Piccaluga, (2000), Cardozo and Engleman (2004) and Harrison and Leitch (2005) have also pointed out the low rate of growth of university spin-offs.

In Spain, there are various articles which show a lower level of productivity and growth in the USOs than in the wider group of start-ups (Ortin and Vendrell, 2010; Rodeiro et al. 2013). One of the factors identified in the literature as most relevant to these companies is the availability of financial reFonts (Tobar, 2004; Sbragia and Ozório, 2004, Diaz, 2004). Several studies have found that the reason why most of spin-offs fail to achieve high growth is that they usually do not obtain the adequate external financing to exploit the business opportunities identified (Evans and Leighton 1989; Veciana, 2005). This gap between the demand for financial reFonts of entrepreneurs and the availability of capital from investors has been detected in countries like the U.S. (Shane, 2004), the UK (Bank of England, 2003) and in general in Europe (European Commission, 2000), causing a direct effect on the ability of these companies to ensure their development (Brown et al., 2004). Thus, the increased number of spin-offs created has not been accompanied by their growth or the creation of a market for private investors interested in them, elements that,

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as noted, are interrelated. Therefore, given the potential for the emergence of virtuous or vicious circles in situations like the one described in this paper we have focused on the search for the barriers to market development.

This paper is divided into four sections. Following this introduction, we theoretically review the risks that are related to companies originating in universities, focusing on the possibility of the existence of an "orientation risk" that is specific to USOs. Furthermore, in order to expose the theoretical implications of this orientation risk, an analogy is made between Akerlof ´s lemon market model and the USO market. In the third section, we propose a statistical analysis of a sample of USOs emerging from the University of Santiago de Compostela, Spain in order to test the hypotheses. Thus, we present evidence for the existence of two different types of USOs; those focused on serving the demands of the market and those centered on research activities. Finally, we stablish our conclusions and propose a series of measures that can help mitigate this problem and therefore increase the level of private investment in the USOs from public research centres.

2. The orientation risk and the information asymmetry in USOs. Similarities between the spin-off market and Akerlof´s lemons market model

The low level of integration of the third dimension of the triple helix, that is, the entry of agents from the region “industry” into USOs suggest that, for them, for some reason, the perceived risks in these type of companies are greater than those present in other start-ups. Among the risks the technological one is especially relevant, derived from the very nature of the USOs. Companies originating from universities are usually characterized by the high technological and innovative components of their products and business models. While this innovative nature is the basis of their competitive advantage, from the economic point of view this often means a high level of intangible assets. This hinders the ability of investors to evaluate the project. According to the financial hierarchy theory the presence of intangible assets increases information asymmetries, because it complicates the identification of the investments made by the company, and the valuation of its assets. Therefore, these assets provide less assurance to third parties, which make difficult for investors from the region “industry” to risk investing in USOs (Cardone and Casasola, 2004). However, these risks are common to all start-ups, factor which has not prevented the consolidation of a market for start-ups, something that is not happening with USO model.

One possible reason that investors are more reluctant to participate in USOs is that in addition to the inherent technological risk of any start-up an orientation risk is added. This risk is derived from the institutional context in which they originate. In this sense, the agents of the region “university” and “industry” often perceive differently the subordination of scientific activity to commercial needs (Cotec Foundation, 2007). Moreover, due to the importance given by the public administration to promote these types of companies, measures have been implemented to increase the survival rate of USOs in stage IV (see Figure 1) ensuring the sustainability of many companies through subsidies. Thus USOs with low commercial activity can be sustained indefinitely through financial support from the region “administration”. This distorts the signs used by private investors to distinguish market-oriented projects from those in which scientific and academic motivations prevail. The difficulty in identifying this orientation risk causes uncertainty about quality of the USO group as a whole.

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The joint existence of uncertainty in the quality and information asymmetry can cause an inefficient market, and therefore under-investment in USOs. The problem is equivalent to that described by Akerlof in his classic lemon´s model. In its original formulation the used car market was used to illustrate how the interaction between heterogeneous qualities of goods and asymmetric information may prevent an efficient market. In the supply side of the market, well preserved cars (referred to as cherries) coexist with worn out cars (referred to as lemons). So while the seller is aware of the category to which the car belongs, it is often indistinguishable to the average purchaser. Given the difficulty the buyer has in assigning different prices, the equilibrium price will be halfway between what he would be willing to pay for a cherry and for a lemon, adjusted by the estimated proportion of lemons on the market. This equilibrium price discourages sellers of cherries so the proportion of lemons will increase causing even more lowering of prices and ending up in a typical expulsion process where "one bad apple spoils the barrel".

Based on these reasons which may result in a lemon market we can establish an analogy of an USO market for investors in which there are also two groups of companies: those that base their activity on market demands (cherries) and those with high levels of public subsidies with reduced sales figure (lemons). We can then analyse some of the similarities between the two markets. The defining characteristics of Akerlof´s lemon´s market will be shown to also exist in the USO market:

1. Buyers can not accurately assess the value of a product through pre-sales analysis, while sellers have full information (information asymmetry).

USO Market: Investors generally do not have a working knowledge of the technologies developed by the USOs which often tend to be very specific. However, company managers are usually scientists who are highly specialized in the technology and they are aware whether they prioritize academic and scientific or commercial gain.

2. Sellers do not have a straightforward way to show the quality of their product. That is, sellers of a high quality second hand car have difficulty demonstrating that quality to buyers.

USO Market: In the case of spin-offs the developed technologies are in their early stages so it is difficult for all agents to identify those with greater commercial potential. USO founders do not have many ways to demonstrate that their technologies or products are commercially oriented to investors

3. The quality of the average product is relatively low. That is, buyers will have a sufficiently pessimistic view about the quality of the products offered in the market.

USO Market: The picture created so far is that of USOs as companies with low growth. There are not enough success stories in this market for investors to perceive them as an interesting target market.

4. There is a lack of effective quality guarantees. That is, the existing regulations cannot sufficiently guarantee the value of the investment.

USO Market: Neither the public administration, the university or the companies themselves have implemented any mechanism to act upon the orientation risk of the USO. So far there has been no mechanism to guarantee or cover part of the risks assumed by investors.

Therefore, based on the five points raised, from the theoretical perspective there appears to be a number of similarities between Akerlof lemons market and the case of USOs. The

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combination of asymmetric information (intangible assets) and quality uncertainty (orientation risk) may be leading private investors not to invest in USO or, if so, demanding particularly high prices (shares) to enter the projects. That is, as Akerlof presented in his model when there is asymmetric information, high quality goods are moved out of the market by low quality goods, causing an adverse selection problem. The test and discussion of the hypothesis of the existence of orientation risk and quality uncertainty in the USO market will be analysed in the following sections.

3. The orientation risk analysis of university spin-offs

To test the existence of similarities between the university spin-off market and Akerlof´s lemons market model we used an extended version of Pombo Romero et al., (2016) database including new variables and data for the same sample of USOs.

The companies selected have met the following criteria: I) be established to exploit research results arising from the activities of research groups of the University of Santiago de Compostela (USC), II) be created between 1999 and 2006, both years included, so that there are accounting records for each company for at least five years. The 20 companies that matched the selection criteria were monitored individually in order to obtain enough data to follow their evolution. The data used has been collected from the accounts filed with the Companies Registry, public grant resolutions and reports of the USC (Pombo Romero et al., 2016).

To determine which USOs are market-oriented and which are focused on research activity three indicators were analysed:

• The proportion of turnover corresponding to sales.

• Evolution of the ratio of tangible and intangible assets.

• Grants and subsidies obtained from public bodies.

The logic of this analysis stems from the fact that between the different Fonts of income of the USO other than sales, government funding programs of private R & D are expected to have a substantial importance in those USOs specialized in "hard" research (USO "lemons" from the private investor´s view). This business model will be reflected in a growing amount of intangible assets resulting from the capitalization of expenditure on R & D. To statistically determine the existence of this segmentation and to identify to which group each USO belongs, a cluster analysis has been carried out referring to the values observed in the fifth year of operation. This time lapse is considered a sufficient period for the USOs to consolidate their business model.

The result of the cluster analysis carried out for the fifth year, presented in Table 1, show, with a very high level of significance, the existence of two groups. Of the 20 companies analysed, four are assigned to the group “lemons” and 16 to “cherries”.

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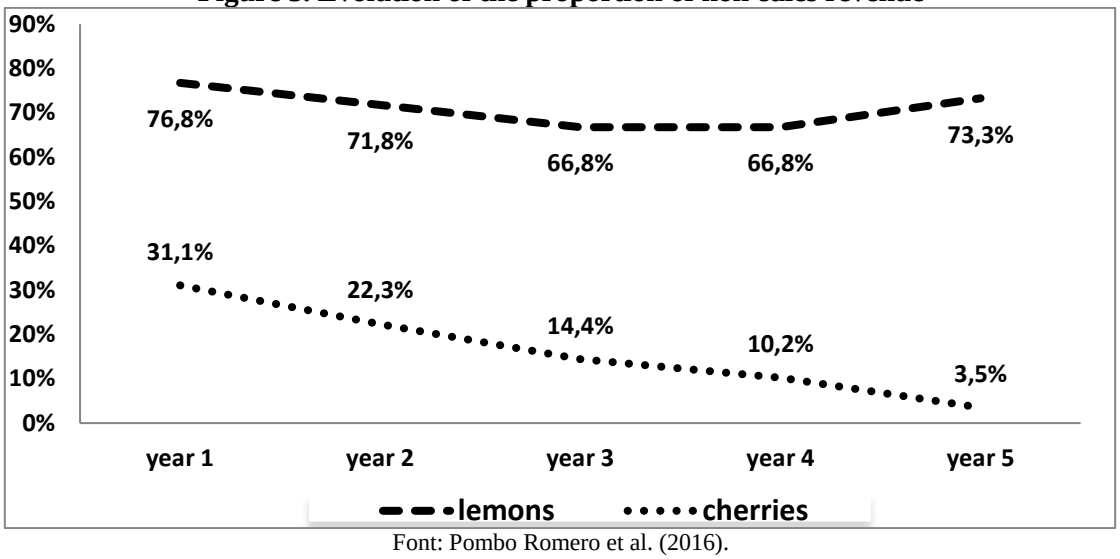
Table 1. Cluster analysis of the USO using the data in their fifth year of operation

Cluster variable	Initial conglomerate centre		Final conglomerate centre		F	Sig.
	Lemons	Cherries	Lemons	Cherries		
Ratio of intangible assets over fixed assets	0,32	0,1	0,63	0,15	9,486	,006
Ratio of non-sales revenue over total turnover	0,99	0,03	0,73	0,06	106,761	,000

Font: Adapted from Pombo Romero et al. (2016).

Based on the classification determined by the cluster analysis in the fifth year, we carried out a comparative analysis of the evolution of both groups, which revealed significant differences in their business models, especially in relation to the Fonts of their income as shown in Figure 3.

Figure 3. Evolution of the proportion of non-sales revenue



Font: Pombo Romero et al. (2016).

The initial income of the USOs IS characterized by the limited importance of the commercial activity so that, on average in the first year of life, sales represent only 53.4% f turnover. This initial dependence on non-commercial income, such as grants or involvement in R&D, decreases gradually in most USOs as a natural result of companies establishing their product market. Thus, in the fifth year, sales represent on average 82% of turnover.

However, this trend is significantly different in a subgroup of the USOs (lemons), which maintained a low level of commercial income over the years (Figure 4). Another fact that shows this trend is the special grant dependency of USOs lemons that obtained 74% of the subsidies in the fifth year while accounting for only 28% of the total turnover of all the USOs (lemons and cherries).

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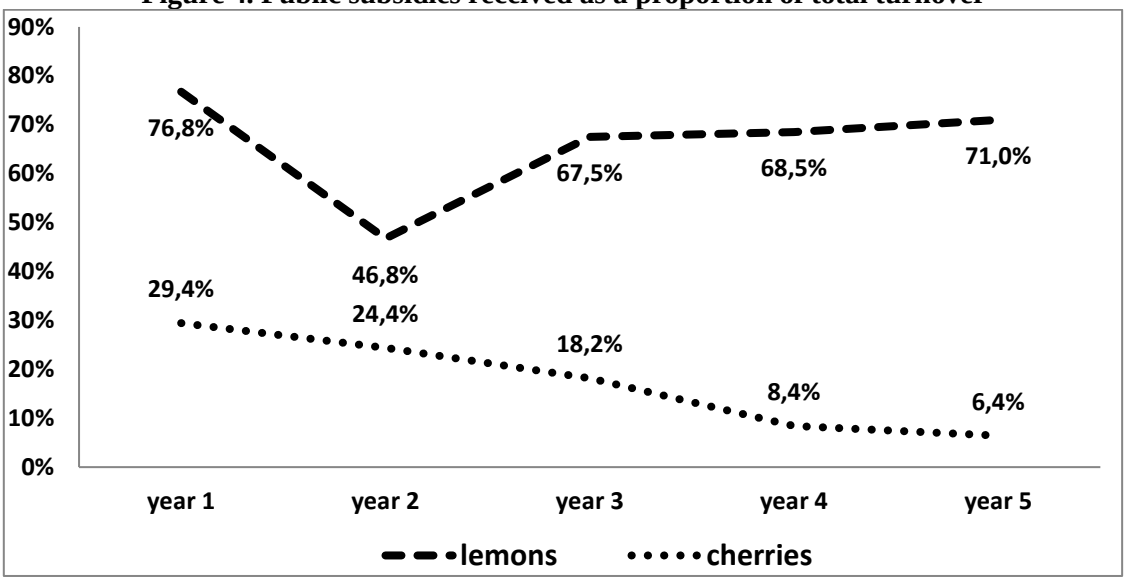
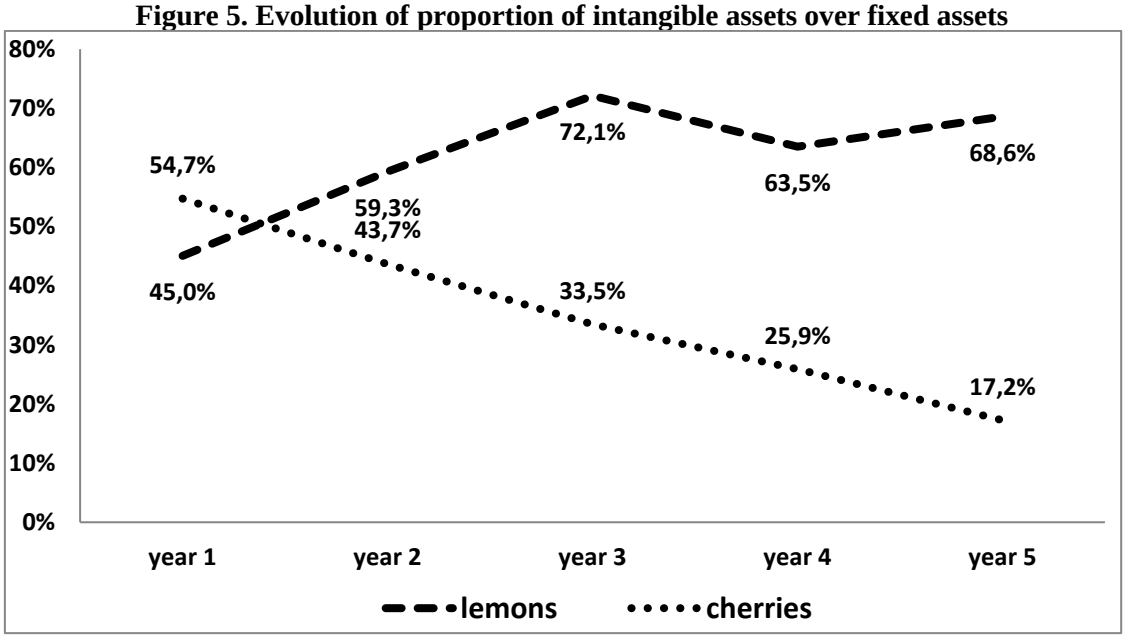
Figure 4. Public subsidies received as a proportion of total turnover



Font: Authors.

Despite their limited commercial activity the USO lemons are supported in zone IV through direct transfers from the region "Government". This can affect the image of the entire USO group as projects with potential growth that would be attractive to region "industry" investors. Based on this data the idea that the subgroup of lemons "decoupled" their activity from their sales takes hold. In turn they focus on "hard" R & D activities by leveraging sustainability policies promoted by region "Government" in phase IV. The balance sheet of these companies is expected to grow by the capitalization of R & D expenditure. This is reflected in a large and growing proportion of intangible assets over all fixed assets. Figure 5 shows that this pattern holds strongly. The business model of lemons means that most of their assets are intangible. Nevertheless, the presence of intangible assets in cherries decreases with time.

Figure 5. Evolution of proportion of intangible assets over fixed assets



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The fact that intangible assets are proportionally larger in USOs compared to conventional SMEs is an expected result due to the activities related to R & D and the intellectual property generation that is applicable to USOs. However, it is shown that the composition of the assets of lemons is especially marked by the presence of intangible assets. Compared with other SMEs, USOs have a significant percentage of intangible assets; some studies claim the figure to be 14% in the Spanish case (Rodeiro et al., 2008). In the sample studied in our work we obtain similar values in companies considered to be cherries. However, lemons generate most of intangible assets as a result of the capitalization of R & D. So while in their first year lemons represent 33% of total intangible assets of the USO group, this figure rises to 92% in the fifth year, something totally disproportionate as lemons represent only 28% of the volume of total business. The evolution of the intangible assets of the lemons causes an increase in the level of information asymmetry in the overall market, in contrast to the cherries group that shows a decrease in intangible assets.

The first condition to look at to conclude if there is orientation risk in the USO market is the inability to distinguish between lemons and cherries at their inception, and therefore potential investors face quality uncertainty. In order to establish whether the orientation is unidentifiable ex-ante a second cluster analysis was carried out, this time based on the data relating to the first year of activity of the USOs. We tested whether USO lemons had their characteristic elements from the beginning or if there were no statistical differences between them and the whole group of USOs. The result is shown in Table 2.

Table 2. Cluster analysis of the USOs (data referring to the first year of operation)

Cluster variable	Initial conglomerate centre		Final conglomerate centre			
	Lemons	Cherries	Lemons	Cherries	F	Sig.
Ratio of intangible assets over fixed assets	0,26	1	0,51	0,38	0,954	,23
Ratio of non-sales revenue over total turnover	0,99	0,03	0,53	0,28	1,75	,11

Font: Adapted from Pombo Romero et al. (2016).

In this case the allocations are not statistically significant, so it cannot be said that it is possible to distinguish lemons from cherries at the beginning of their activity, which would support the existence of orientation risk. However, we note that using the variable proportion of non-commercial revenues in year 1 as classification criteria, 3 USOs are assigned to the lemon group and 17 to the cherry group. These three lemons were also classified as such in the test for year 5. While this assignment in the first year is not statistically significant, the F-statistic is high (1.75). Given that this value is so high and the fact that there is considerable overlap between the companies assigned to each group in year 1 and year 5, this could be interpreted as an indication that the proportion of non-commercial turnover in the first year could be a predictor of the final orientation of the USO.

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4. Conclusions, recommendations and limitations

The results showed that a significant proportion of the USOs present a different pattern from that expected in start-up companies. These USOs are characterized by limited commercial activity, sometimes almost token, throughout the years. Their viability depends on their ability to generate revenue from different public support programs. From the financial and economic point of view, this fact causes their balance sheets to evolve through capitalization of R & D rather than as a result of organic growth resulting from the introduction of new products in the market. This evidence makes necessary the analysis of the underlying causes of this situation, the discussion of the implications derived and the consideration of those measures that may mitigate the negative aspects.

Economic literature contains a number of proposals to solve the so-called lemon markets, which generally can be grouped into two distinct streams. On one hand, some authors emphasize the need for active measures to control or regulate the market. On the other, there are those who focus their attention on increasing the capacity of buyers to discriminate between lemons and cherries. Based on the view of first group a series of laws under the name of "lemon-law" (Magnuson-Moss Warranty Act) have been created in the U.S. Its aim is to protect buyers, of cars and other products, which have not complied with quality and performance standards. Essentially these regulations allow buyers to void contracts by virtue of insufficient quality observed after purchase. The application of a law of this type to the USO market is truly complicated, which in any case does not prevent the search for solutions aimed at offering greater guarantees to the buyer, thus facilitating investments. In this respect investment instruments could be established to reassure new USO partners or investors. This does not mean that it is necessary to override the assumed risk, making investments in USOs riskless, but the orientation risk must be minimized. On a practical level actions in this regard could include:

4.1. Line A: Measures to guarantee investments

A1. Mutual guarantee companies. Such financial institutions are intended primarily to facilitate SME access to credit by guaranteeing the payment of debts. The creation and use of this instrument applied to the USO market could be an alternative to help finance the spin-offs by guaranteeing the loans. The extension of these guarantees not only to lenders but also to investors is another possibility to consider

A2. Repurchase agreements. After a sufficient period of time to follow the evolution of the USO, investors may have the option to cash in their share if the company fails to achieve a number of milestones in its evolution. Although this measure has already been tried, frequently the repurchase by the enterprises themselves may be impossible, so to act in this direction a government fund would be an alternative to reduce the risk for investors.

A3. Tax breaks. Increasing tax incentives for investment in these businesses could offset the orientation risk to some extent. We must remember that today, in some countries the monetary contributions to capital for spin-offs of informal investors are not entitled to a tax deduction. Public administration can be crucial through supportive policies for investors (formal or informal) in their operations with USOs.

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The second trend is that of those authors who oppose the regulatory approach as a possible solution on the basis that despite regulation, certain lemon market problems have not been solved. This school of thought led by authors such as William L. Anderson finds limitations in the lemon theory derived from the fact that in its original formulation it ignores the fact that consumers themselves can find ways to ensure the quality of goods and a seller can assess the damage to his reputation arising from placing lemons on the market. It is open to discussion to what extent in the case of the issue of the USOs "reputation" is valued by individual sellers, as these, in principle, have no intention of funding another company in the near future. However, we must consider the reality that for the founders of a USO there are incentives to look after their reputation as they often return to the financial market on more than one occasion. In any case, we have grouped the proposed measures within this stream into two lines, one to facilitate the interaction between agents and their understanding of each other and another to control the flow of public subsidies gained by the spin-offs. In the former, the goal is to promote understanding of investors of the issues they consider critical to their decisions. In this sense, the two principal factors referred to by investors to predict the success of the start-ups are the characteristics of the entrepreneurs themselves and the technology on which the company is based. The concrete steps to facilitate this knowledge would be:

4.2. Line B: Facilitating knowledge between investors and entrepreneurs

4.2.1. Entrepreneurs

Interpersonal relationships are critical to the establishment of a partnership based on trust between the parties. While this may be obvious, there are not many instances of personal relationships fostered between university entrepreneurs and investors. Some universities in developed countries are pioneers in this type of activity, such as the MaRS model of innovation and commercialization in Canada. The recommendation to establish intermediate centers of transfer of knowledge was also emphasized in the report "Ingenious Britain: Making the UK the Leading High Tech Exporter in Europe" (Dyson, 2010), and therefore proposes the creation of a new set of centres of excellence in research fields of strategic economic importance. Actions in this context are intended to provide a space for interaction, to promote staff mobility between universities and industry or to use shared facilities and equipment to obtain synergies and reduce costs, key issues for economic viability. In brief we will quote some policies that should be implemented to improve the mutual knowledge of investors from the region “Industry” and entrepreneurs from the region “University”:

B1. Creating communal physical and / or virtual spaces

B2. Developing part of doctoral studies in businesses

B3. Promoting seminars and presentation of projects to private sector and investors

4.2.2. Technology

One of the most challenging elements to economic valuation of USOs is the identification of the technologies employed. Entrepreneurs have a high knowledge of the specific technologies that are the basis of the company but generally these are unknown to investors to a greater or lesser degree. To close this gap, universities and spin-offs should have the mechanisms to exhibit their patents, technologies and / or products, as many

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investors have no direct contact with what being done in the universities. It is also necessary to provide potential investors with the necessary tools to assess the value and the validity of the technologies, or in any case, that the entrepreneurs demonstrate a personal commitment with those valuations. In this regard a commercial analysis of the products and technologies in their early stages would be useful in order to identify the optimal markets. Some of the possible measures to be applied would be the following:

B4. To create user friendly databases of patents and technologies that are accessible to investors.

B5. Facilitate access to reports by external experts in the various fields of knowledge to which the technology could apply, for investors.

B6. Preparation of business plans conducted by independent consultants.

B7. Incentivize technology transfer staff based on the commercial success of the projects in which they work.

The second group of measures is aimed at controlling the public subsidies received by USOs. As shown in this paper, there is an USO group that is receiving subsidies on a continuous basis without this translating into an increase in commercial revenue. This causes investors mistrust to grow, not only in these specific companies, but also in the whole USO group. It is therefore necessary to establish some form of control over subsidies. From an economic point of view, this would entail greater selectivity when it comes to selecting projects to be financed, as well as establishing of a maximum amount of financial assistance as well as personal commitments from the partners themselves. There is also a need for greater coordination between the different administrative bodies that provide business support grants to prevent certain USOs taking advantage of various subsidies from different agencies for the same project, limiting the use of these limited reFonts as a substitute for sales revenue. Below these measurements are presented in summary.

4.3. Line C: Measures to control subsidies granted

C1. Improve the vetting procedures of public grants allocation.

C2. Establish commercial milestones to be achieved (e.g. Setting targets within a given timeframe for net sales, market access and / or agreements with third parties).

C3. Establish productivity milestones to be achieved (e.g. Setting targets within a given timeframe to register patents or for launching new products on the market).

C4. Setting a maximum time limit to receive public grants.

C5. Coordination between the different administrative bodies that provide grants for USOs.

Finally we should note some limitations of this paper such as the small size of the sample analysed, its concentration in a single university and the limited time frame analysed. Our ultimate goal is to expand both the sample and the time frame in future work. We believe that the importance of the USO phenomenon, the lack of scientific contributions in this context and the availability of sufficient data to carry out a statistical analysis, make the

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ISSN 2183-5594

analysis presented here highly relevant. We consider it a necessity to solve those problems that are already evident in the existing model of USO promotion and support. This only can be effectively done by adopting a critical approach to the analysis of the results obtained so far by the technology transfer programs.

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