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Identifying Rural Areas using Entrepreneurship Indicators: a Case Study in Greece

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Abstract - **The need for a more comprehensive, multidimensional tool for policy formulation and evaluation became evident when the negative repercussions of the EU Common Agricultural Policy (CAP) had to be faced by policy makers in the early 1990s, especially in response to rural depopulation, increasing income inequalities, and environmental degradation problems. Over the last thirty years, agricultural regions in Greece have undergone dramatic structural changes, which in turn have altered their rural identity. Changes in employment composition is an indicator of the transformations taking place in the agricultural sector, and claim for more comprehensive methodologies for rural areas for profiles. The emerging need for developing new methodologies for traditionally rural and rapidly changing regions in Europe, is pertinent to rural policies. This paper comments on the possible use of an original classification criterion based on the entrepreneurial trajectory of rural areas. Aiming at the requirements set by the new EU Rural Development Regulation EC 1698/2005, the existing methodologies are also reviewed, their strengths and weaknesses are presented, and the emerging need for an enhanced tool for rural classification is finally discussed. The classification-typology is best derived when accounting for variables describing the entrepreneurial activity in rural areas using a flexible and effective response to policy needs (policy targeting and monitoring of rural development).**

Keywords - *Rurality; Rural typologies; Spatial approach; Developing regions; Mediterranean.*

1.   Introduction

The distinction between broad and narrow rural policies (e.g. macroeconomic policies, policies on agriculture, transport, public lands, and the environment) generates questions regarding the appropriate definition of rural areas. More specifically, broad rural policies are sectoral policies with a significant impact on rural regions. On the other hand, narrow rural policies are those that aim explicitly at the development of rural areas and are mainly localized at the regional scale. These are, in other words, "territorial" policies, addressed to particular places, departments or lower levels of governance (e.g. prefecture).

A more sophisticated appraisal of the baseline justification for rural development policy, requires an understanding of the processes which drives the socio economic changing in different rural regions context. The identification of various typologies of rural regions, however, requiring to be rigorous and quantitatively based, is supported by spatially differentiated theories and models.

According to a study of the United Nations Economic Commission for Europe -UNECE (UNECE, 2005), there are many definitions for "rural" all over the world. Moreover, there are several definitions in use within a country. The differentiation, both within a country, and among countries, depends on the different variables used to distinguish rural from non-rural areas, as well as the different variables thresholds and the spatial unit of analysis.

Most definitions are a combination of two or more variables taken among the following set: population density, the ratio of population commuting, density of workers, the rate of population increase, ratio between population density and

density of workers, the employment rate in the primary sector (UNECE, 2005).

An overview of urban-rural delimitations and classifications of ″rurality″ was performed, with a particular attention, to those definitions which have been operationally linked to rural development policy.

The following methodologies were analysed, according to NSSG (2004):

* The O.E.C.D methodology;

* The Eurostat methodology degree of urbanisation;

* Less favoured areas approach directive 75/268;

* Existing national methodologies for spatial classification namely:

  ▪ The methodology of the National Statistical Service regarding the degree of urbanisation in Greece and the mountainous character of the Greek areas at LAU 1 level;

  ▪ The integrated rural programs in specific areas in Greece;

  ▪ An original approach suggested by the Hellenic Ministry of Economy and Finance;

  ▪ Methodologies followed by other member states of the EU (EUROSTAT, 2005).

The main conclusions from the implementation of the existing methodologies in use, in the case of Greece, are described here after.

The OECD methodology distinguishes two hierarchical levels, local (commune = LAU2) and regional (NUTS3). At the local level rural communities are defined as having a population density below 150 inhabitants/km^2. At a regional level, larger functional or administrative units are distinguished by their degree of rurality, depending on what share of the region's population lives in rural communities. Three types of regions are used:

* predominantly rural regions: >50 % of the population living in rural communities;

* significantly rural regions: 15 -50 % of the population living in rural communities;

* Predominantly urban regions: <15 % of the population living in rural communities.

Each NUTS3 region in the European Union belongs to one of these three types of regions.

This methodology is focused on population density as a key variables and classified Municipalities (LAU 2) with an arbitrary density threshold. The percentage population distinguishes municipalities (LAU 2) into densely or sparsely populated areas. For Greece, the two main urban areas with more than 50% population of the whole country, non-rural prefectures (predominantly urban) accordingly, are only Attiki and Thessaloniki. The remaining NUTS 3 prefectures are all classified as rural (significantly or intensely-predominantly rural).

It is undoubtedly apparent that population density parameters also provide information on the economic features of an area. As such demographic data are indeed available at low geographical levels, the OECD methodology has been internationally implemented. Unfortunately, the OECD methodology has serious limitations, especially due to the fact that for the implementation of rural policy it is required the ability to capture information for smaller geographical units with distinct characteristics. The variation of those characteristics is not considered incorporated into the methodology, as it is evident in many instances.

On the other hand, the Degree of Urbanisation - EUROSTAT methodology is a reliable tool for the classification of urban areas. This methodology distinguishes the following three types of areas:

* densely populated area: contiguous set of local areas, each of which has a density 500 I/km^2, and where the total population for the set is at least 50.000 inhabitants (I);

* intermediate area or moderately dense: moderate dense contiguous set of local areas, not belonging to the densely populated area, each of which has a density > 100 I/km^2, and either with a total population for the set of at least 50.000 inhabitants or adjacent to a densely populated area;

* thinly populated area: contiguous set of local areas, neither belonging to a densely populated area nor to an intermediate area.

It must be specified that a set of local areas summing up to less than 100 km, not reaching the required density, but entirely enclosed within a densely-populated or intermediate area, is to be considered to form part of that area. If it is enclosed within a densely populated area and an intermediate area is considered to form part of the intermediate area, it is noted that a "local area" corresponds to the communes or municipalities in most of the cases in all metropolitan areas.

The considered indicators allow for international comparisons for their simplicity, although the methodology has serious shortfalls when it comes to the design and implementation of rural policies, mainly because of the incompatibility of the criteria used in relation to those used by the EU regulations.

The methodology, used by urban National Statistical Service of Greece, for many years has provided a simple tool for rural classification according to the degree of urbanism. This is achieved by using together population and elevation thresholds. Although this approach definitely enhances the analytical strengths of the methodology, it is insufficient for implementing rural planning and development measures and policies that are based on the existing EU legislation.

Finally, the informal approach that has been used by the Hellenic Ministry of Economy and Finance is based on a multi-criteria analysis of space classification. The suggestion was to use the Labour Force Accounts (LFA) criterion in combination with the urbanisation criterion of OECD. This way, the OECD methodology provided the framework for a broad classification at higher levels, relying on the population density, while the LFA criterion suggested as an additional key variable, appeared to be a strong tool for rural areas development programmes (Benaki, 2005). This methodology took into account all the necessary economic, social and physical geographical criteria in order to classify the Municipalities (LAU-2).

However, this type of methodology also used arbitrary thresholds. The evaluation of criteria is subjective and therefore potentially biased. In the case of Greece, the advantage of such an approach is the availability of the required statistical data. Although the proposed classification provided several advantages by combining several factors, which ameliorated the classification process, it was far from a reliable methodology, especially in view of the changing structure of the Greek economy, with the emphasis placed on entrepreneurial development throughout the country.

2.   Logical Framework

The dramatic structural changes in the employment and activity composition that are taking place in Greece have altered the rural nature in the largest part of the country. This trend becomes evident when one looks closely to entrepreneurial development statistics for the past few years. According to a recently published report conducted by ICAP (ICAP, 2007) on the capital and enterprise

mobility in Greece for the period 2000-2006, based on the business capital taxation data for that period, an increasing trend of the number of newly founded enterprises (S.A. and Ltd. types) appeared for the year 2005, after a period of decreasing numbers of new enterprise development. This inverted increasing trend continued in the following year (2006) with an even higher rate of growth (10.7%). More specifically, during 2006, for the first time since the year 2000, there was an increase in the total amount of the initial capital recorded for newly founded companies that was also significantly high as a percentage (30.5%). Further, 4,581 new companies were founded in 2006, of which 69.8% belong in either one of the manufacturing, trade, energy or financial services sectors. New business development is also accompanied by a larger proportion of new types of companies (real estate, construction, advertising, consulting services etc.) as compared to the more traditional types. Finally, the vast majority of the newly founded companies (64%) are officially registered in the prefecture of Attiki (the wider Athens Metropolitan Area), and a significant, however, much smaller percentage of companies is registered in Thessaloniki (Greece's second largest Metropolitan area). This enhanced business activity environment, has a definite impact on the nature of all regions of the country, although the impact is relatively more obvious in typical rural areas. It is therefore reasonable to suspect that entrepreneurial criteria shall also play a more significant role in elucidating the different typologies of rural areas in Greece.

3.   Methodological approach

This study attempts to enhance the existing methodological tools and approaches for rural areas definition, by introducing the entrepreneurial activity as a key classification variable. Our proposition is that in order to have flexible responses to policy needs (policy targeting and monitoring of rural development), the classification-typology is best derived when accounting for entrepreneurial activity parameters.

Births and deaths of enterprise data for the year 2003 (municipality level) for Greece are used (Source: Business Register of the NSSG). The NSSG Business Register does not include all the agricultural enterprises (holdings). It includes about 100,000 holding from a total of approximately 840,000 holdings of the Farm Register. The statistical data is fed into the Farm Register through VAT declaration information of the Hellenic Ministry of Economy and Finance, and distinctions are made based on the size

of the turnover and the employment of the holdings. Therefore, the data base available that was used in the current study is lacking agricultural activity data and this fact explains why predominantly large rural areas on the thematic maps which were produced show different than the actual levels of enterprise activity. However, this limitation by no means corrupts the main findings of the study, given that data base used is large enough to allow for reliable conclusions.

A set of GIS maps were produced, initially mapping enterprise births and deaths for all sectors in absolute numbers. Following that, the ratio of births over deaths of enterprises in all sectors was created and the relevant map for Greece was produced. The ratio shows the net enterprise activity development in an area.

In order to comparatively view the spatial relationship between enterprise activity and the typology generated by the (Degree of Urbanisation) EUROSTAT criterion at a first stage, and following that, the typology generated by the (Rurality) OECD criterion, a set of GIS maps was created, at which the enterprise activity data layer was overlaid to that of the Degree of Urbanisation – EUROSTAT, and then to that of the Rurality – OECD. The underlying assumption is that enterprise activity is an entrepreneurship indicator, which is in turn related to the urban structural characteristics of the area. Thus, the level of entrepreneurship change provides us information on the extent to which an area is rural or urban. The main issue is that for the case of Greece (and for other countries with structural changes in rural areas) the EUROSTAT and the OECD criteria are both limited, and certainly do not capture significant spatial variation in the economic activity, and hence the degree of urbanisation or rurality. This limitation impacts on policy design and implementation in areas undergoing socio-economic changes. Finetuning policies on the basis of a better understanding of the rural or urban nature of an area is therefore of great importance.

4.   Results and Discussion

The absolute numbers of births of enterprises recorded in Greece in 2003 for all sectors are presented in Figure 1. A two layer map, overlaying the thematic map depicting the EUROSTAT - Degree of Urbanisation criterion over the births of enterprise (in absolute numbers) map is also presented, as well as a second two layer map overlaying the thematic map expressing the OECD - Rurality criterion over the same births of enterprise base map.

The number of newly created enterprises varies significantly across the country, even within relatively small geographical regions. The number of newly created enterprise increases in many areas, but no systematic correlation with the EUROSTAT - Degree of Urbanisation classification was observed. However, densely populated areas are associated with higher enterprise births. The third map, using the OECD criterion, gives us further information on the level of enterprise growth, across predominantly rural areas in Greece. Thus, the spectrum of urban attributes in a predominantly rural space, as the Greek case appears to be, are much better captured when accounting for the additional entrepreneurship variable.

In Figure 2, a similar set of thematic maps are presented, providing information about the number of enterprise deaths for the year 2003. While it is reasonable to presume that increased enterprise activity is a good proxy for increase in urbanisation, the contrary is not necessarily true. This means that decrease of enterprise activity are not always associated with the transformation of a region toward a rurality type. In fact, it can be induced from a closer look of the thematic maps that the areas that exhibited increases of enterprise activity, also exhibit decreases, although at a lower rate.

In Figure 3 a set of thematic maps is also presented. This time the ratio of births over deaths is mapped out, and overlaid on the EUROSTAT and OCSE criteria maps. The ratio actually presents the net entrepreneurial activity across the country.

For most of the country (based on the cross-section enterprise activity data for the year 2003) the ratio is below 1. This result is consistent with the widespread rural character of the largest part of Greece, with the obvious exemptions of the urban agglomerations.

The comparison with the EUROSTAT criterion is confusing as to the urban character of certain areas, but is enlightening as to the rural areas.

As to the comparison with the OECD criterion, we can conclude that it captures the variation within significantly and predominantly rural areas as to the urban like attributes due to net enterprise development.

5.   Conclusion

The results of this study support that enterprise activity could represents a key variable for developing a more precise way of defining the level of an area. This paper tested a basic indicator for

measuring entrepreneurial activity, namely the enterprise births and deaths, and explained why such information could improve the effectiveness of the existing methodologies. However, more detailed research could focus on the examination of entrepreneurial activity indicators. Entrepreneurship is a multidisciplinary concept (Deakins, 2006) and the introduction of such criteria shall account for area-specific and society-specific characteristics, and hence should be carefully designed. Finally, methodologies that use entrepreneurship change as a variable produce results that are more consistent with the EU intervention measures, especially after the Lisbon Strategy was adopted by the EU.

The analysis of time-series data for births and deaths of enterprises is an useful tool to draw some concrete conclusion for the behaviour of the entrepreneurial activity and its correlation with rural areas especially in Mediterranean development regions.

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Figure 1 – Comparison map of births of enterprises in all sectors recorded in Greece (2003) with EUROSTAT-Degree of Urbanisation and OECD – Rurality criteria.

Figure 2 – Comparison map of deaths of enterprises in all sectors recorded in Greece (2003) with EUROSTAT-Degree of Urbanisation and OECD – Rurality criteria.

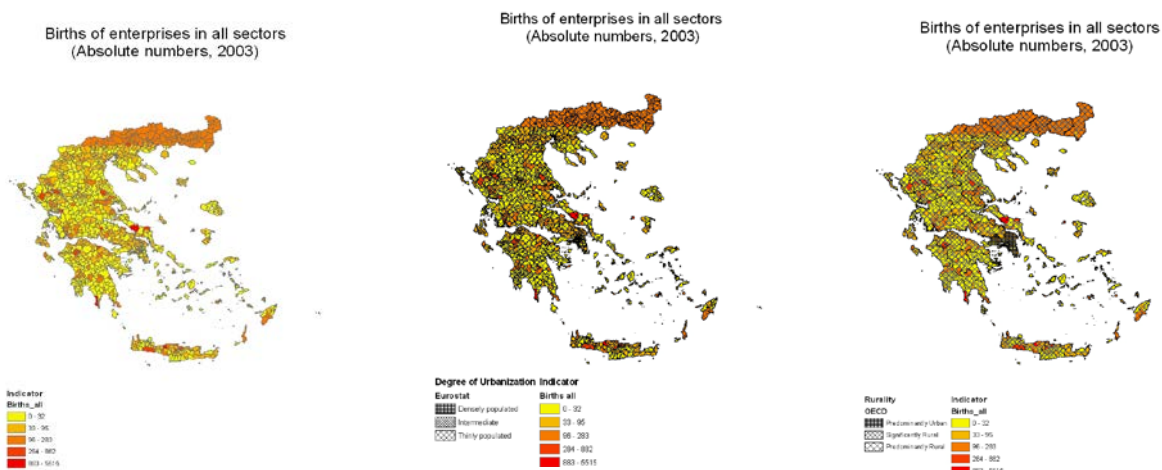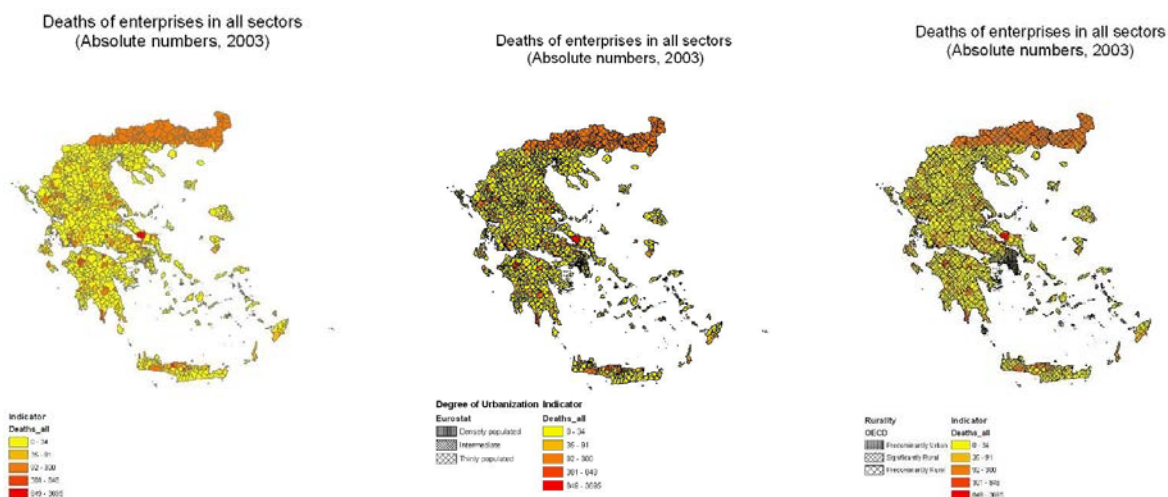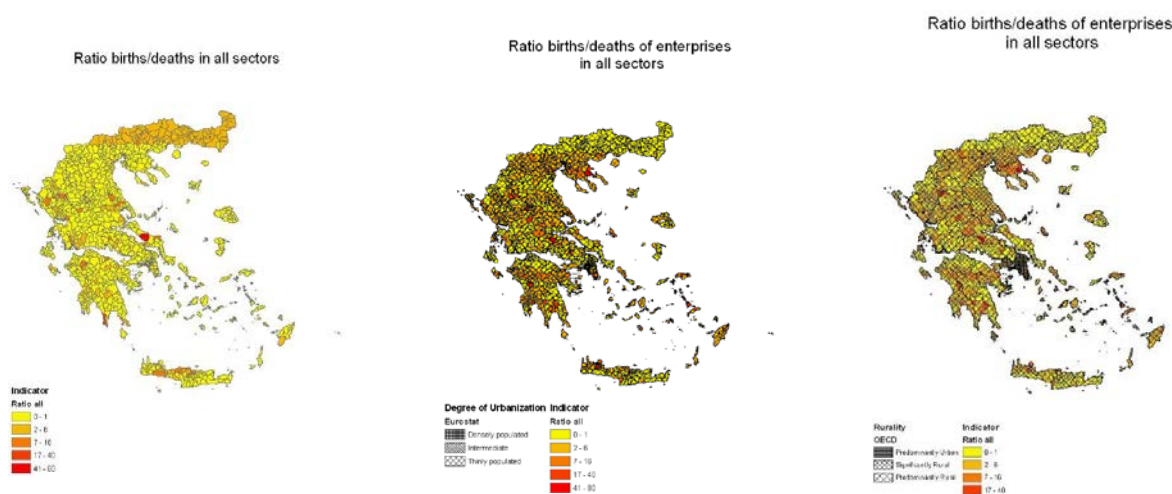**Figure 3** – Comparison map ratio births/deaths of enterprises in all sectors recorded in Greece (2003) with EUROSTAT-Degree of Urbanisation and OECD – Rurality criteria.

Managerial Flexibility in Turbulent Times of Crisis

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Abstract - **The recent change in the global economic environment produced a significant transformation in the conditions that affect managerial decisions. In fact, the increase in globalization led to higher managerial flexibility and a transformation in competition. Additionally, the financial crisis caused a lack of liquidity in financial markets. These circumstances originated a shift in the way investment opportunities should be analysed in global industries. Managerial flexibility can translate itself into expansion to other markets besides the initial ones. This possibility is analysed in the existing literature through real options analysis. In global markets competition is assured by global firms. However, the number of these firms is scarce. Therefore, global competition is made by a limited number of firms. This type of competition is analysed in the existing literature through game theory. The lack of liquidity in financial markets makes financing harder to obtain and exacerbates the conflicts of interests between the different stakeholders of a firm. Such conflicts are studied in the existing literature through agency theory. Therefore, a real options analysis under agency conflicts between equity and debt in the presence of competition is well suited to analyse investment opportunities in the present economic environment. The setting under which such analysis is performed considers two firms in a market that share a growth option to expand its scale of operations for a fixed investment outlay. The firms are financed by both equity and debt and the exercise of the expansion option is financed by an additional equity issue. Cournot-Nash equilibrium is considered and two alternative managerial policies are set: a first-best policy, which maximizes the value of the firm and a second-best policy, which maximizes the value of the equity of the firm. The results obtained with the numerical simulation performed demonstrate that agency costs exist in the presence of competition and lead to an underinvestment situation.**

Keywords - *Real Options, Agency Theory, Game Theory and Capital Structure.*

1. Introduction

The economic environment in which firms operate is in constant transformation. The growing globalization of the market economy affects managerial decisions and changes the paradigms under which such decisions are based on. In fact, globalization makes competition ever greater in a wide variety of economic sectors because of the easier access to other markets beside the internal ones. It also tends to make investment opportunities more flexible due to a broader applicability of technology to other purposes besides the original ones.

Today, in many economic industries the focus of competition is set at a global scale. Globalization of the market economy makes competition transferable to a world level. However, the possibility to compete at a global scale is only accessible to a limited number of firms. Therefore, such general increase in competition also causes a difference in the type of competition global firms have to face. In fact, such competition is being performed by a limited number of firms in each particular industry. We are witnessing an increase in competition by global firms that compete among themselves in different markets and in different products. In this setting, models that take into account the impact of one firm's decisions in the other firm's behaviour are the ones that better adjust to this economic environment. Therefore, game theoretic models of competition gain a renewed relevance.

At present, managerial flexibility is getting more and more present in investment opportunities. In fact, an investment opportunity, directed to a particular market, can more easily be replicated and developed to a broader one. In addition, technological breakthroughs can more easily be transferred to other industries. With globalization, access to external markets and the expansion of the initial concept to other realities is more easily performed. These two combined aspects lead to an increase in operational flexibility and highlight its present relevance. Models that incorporate such managerial flexibility are models that are best suited for today's economical

environment. Therefore, real options models gain a renewed relevance.

Additionally, at present times we are facing tremendous constraints in financial markets. The recent financial crisis affected immensely the way in which financial markets operate and their capability to provide the necessary funding to firms. This increased difficulty results mainly from a lack of liquidity in these markets. Among others, three consequences from this situation are worth being mentioned for the purpose of the present research. Firstly, the financing of investments is now a harder task than it was before. Secondly, the problems between the different stakeholders of the firm tend to be worse than before. Thirdly, it is much more difficult for firms to rollover their initial debt issues. Models that take into account these different, yet complementary, aspects reflect better the actual economic environment. However, we shall concentrate the analysis in the problems that arise between the different stakeholders of the firm. Therefore, agency theoretic models gain a renewed relevance.

Despite the fact that the above mentioned effects are not all reflected in all industries, they are widespread in different magnitudes to different industries. However, for some particular industries they are all present. In fact, global firms which operate in markets where entry barriers do exist face all the above mentioned effects. They face a fearsome competition but only from a limited number of rivals. They generally possess high operational flexibility since they can easily proceed to other markets, hence they are global. They also possess technology that can easily be adopted by other industries, thus enlarging such operational flexibility. And finally, they also face financial constraints because of the lack of liquidity present in financial markets, which causes agency conflicts between their stakeholders.

As a consequence of all these combined effects, a reflection about the new conditions that affect managerial decisions is necessary, namely, decisions concerning investment opportunities. With this new economic environment investment decisions are particularly affected. Higher economic uncertainty increases the risk associated with expected future cash-flows. Lack of liquidity in financial markets increases the cost of equity and debt financing.

The focus of the present research is the analysis of the impact of the financing structure in investment decisions that present managerial flexibility in a competitive market. However, such model must depart from previous work developed in the different fields of research that are being integrated.

Smit and Trigeorgis (2004) conclude that market structures portray an influence on the firm's investment decisions. In a static approach to competition, it was shown that different market equilibriums, namely Cournot-Nash and Stackelberg, result in differences in the investment decisions of firms, and therefore, in firm value. In a duopoly setting, with both firms sharing a growth option and possessing an abandonment option, alternative competitive responses are analyzed. Departing from the monopolistic market structure as benchmark, the analysis derives the expressions for firm value under Cournot-Nash and Stackelberg equilibriums. Therefore, it is examined how such equilibrium competitive responses influence investment decisions and firm value through the differences in firm value compared to the monopolistic market structure.

Mauer and Ott (2000) and Childs et al. (2005) demonstrate that the exercise of growth options can, under certain financial structures, lead to an underinvestment problem, due to the existence of agency conflicts between equityholders and debtholders of the firm. In a typical underinvestment situation, equityholders decide to invest later in a project (with similar risk characteristics to the existing portfolio of investment projects) when compared to the optimal investment timing because the increase in the asset base will increase the value of the debtholders' claims at the expense of equityholders. Rather than investing when it is optimal for the firm, equityholders tend to wait until the market evolves favorably and invest at a higher price of the underlying asset / project when the increase in value of the debtholders' claims is not accomplished at the expense of equityholders. Since the debtholders claim is fixed, they cannot expect to gain more than seeing their claim become riskless. This can occur either by a reduction on the volatility of the underlying asset or by an increase of the asset basis of the firm. If the increase is due to an additional investment performed by equityholders, the debtholders will benefit from it without having incurred in any additional cost. On the equityholders perspective, whatever return their additional investment yields, it is going to be shared with the debtholders. They support all the costs and have to share the benefits. If equityholders wait to invest at a higher value of the underlying asset (project's present value), debtholders will have already benefited from this increase and whatever return equityholders get from the investment decision, it will no longer be shared with debtholders. This explains why, in the

presence of pure expansion options, equityholders have an incentive to underinvest.

Therefore, in the present research a discrete-time real options analysis will be implemented. The model must also take into account the existence of agency conflicts between equity and debt in a scenario where competition between two identical firms is present. Furthermore, it will be specified that both firms will act as Cournot competitors.

2.   Research Background

In this section a brief review highlighting the fundamental research that relates managerial flexibility in the presence of agency conflicts between equity and debt and in the presence of competition will be specified.

2.1.   Agency Conflicts under Real Options Analysis

In this section we will briefly review some of the most relevant articles that contribute to the study of the interactions referred to above. We will start with the reference to the main articles that refer to the interaction between investment and financing decisions until a central article that performs such analysis in a real options framework and conclude with the first introduction of competition in a context of managerial flexibility.

The celebrated paper from Modigliani and Miller (1958) stated explicitly the indifference between different financing alternatives and the irrelevance of financing decisions to the market value of the firm. Consequently, it implied that firm's investment decisions are independent of its financing policy. In fact, they demonstrated that given the firm's investment policy and ignoring taxes and contracting costs, the firm's choice of financing policy does not affect its current market value. Despite the huge breakthrough in financial theory that such recognition enabled, it left unanswered the observed practice of corporate financing policies. Later, introduction of corporate and personal taxes as well as assumption of bankruptcy costs led to the failure of the indifference proposition, so that the firm must choose an optimal financing method. However, under these developments, the independence proposition still holds.

Later, Jensen and Meckling (1976) studied the impact that an agency conflict among stockholders, managers and bondholders has on the investment and financing decisions of the firm. They argued that the capital structure problem involves the determination of the entire set of contracts among the different stakeholders of the firm. Afterwards, Myers [9] argued that, in the presence of debt financing, a conflict of interests between equityholders and

debtholders emerges. With this recognition, the financing structure is no longer irrelevant to the investment decision of corporations.

Mauer and Ott (2000) studied the impact of managerial flexibility in the relationship between investment and financing decisions. In a real options and agency theoretic framework, they argued that levered equityholders of a firm with assets in place and owning a growth option to expand its scale of operations, have an underinvestment incentive whenever the growth option is solely equity financed. An underinvestment incentive is traditionally viewed as investing less than the optimal in order to avoid a wealth transfer from equityholders to debtholders. However, it can also be viewed as a delay in the optimal investment timing, which ultimately might lead to a reduction in investment.

2.2.   Competition under Real Options Analysis

The initial model developed under this setting was Smit and Ankum (1993). Despite the intuitive presentation of fundamental aspects relating competition with investment possibilities the framework was not continued until Smit and Trigeorgis (2001). They analyzed in discrete-time the trade-offs between managerial flexibility and commitment in a dynamic competitive setting under uncertainty. In fact, they extended the framework developed in Smit and Ankum (1993) by explaining the source of firm heterogeneity and quantifying the trade-off between commitment and flexibility.

Smit and Trigeorgis (2001) considered a scenario where two firms compete in two different stages of product development. Under this scenario, the early exercise of strategic investments can change later stages for the better. In fact, it can open new market opportunities or enhance the value of their investment options. Therefore, a firm can make a first-stage strategic investment possibly altering the later equilibrium strategic choices. Firms are initially assumed equal in the second competition stage but one firm may introduce some asymmetry by making this first-stage investment. Hence, the initial investment decision requires the firm to weigh the commitment cost against the expected future strategic benefits of commitment. For the different possible investment orderings considered, simultaneous, sequential or singular, it is defined a set of corresponding market outcomes, Cournot, Stackelberg or monopoly. These market outcomes are used to calculate the final payoffs. Following Fudenberg and Tirole (1984), the strategic effect of the committing first-stage investment depends on the type of competitive reaction and the nature of the commitment. The firm's investment is either tough or soft. If firm (re)actions are strategic substitutes (as under Cournot quantity competition), the competing firm will engage less for an aggressive action by the

rival firm. Conversely, firms' (re)actions can be strategic complements (as under differentiated Bertrand price competition). Smit and Trigeorgis (2001) construct and solve four numerical examples illustrating all possible combinations of competitive reaction and the investment type. Upfront investment is only optimal for the first firm to act in the two cases where the strategic effect is positive. For the cases with negative strategic effect, the first firm to act should not invest. It should benefit from increased uncertainty as its stage-two investment option becomes more valuable. But at the same time uncertainty erodes the value of committing as the upfront investment becomes riskier. Smit and Trigeorgis (2007, 2009) use this framework to assess R&D strategies and infrastructure investment decisions.

3. A Discrete-Time Agency Real Options Game Valuation Model

In the present section, a description of the discrete-time model developed is made. Next, a validation of such model, with the use of a simulation methodology is also made. The results achieved with such simulation are presented and analysed.

3.1. The Model

With two firms present in the market, we must start with the consideration that both firms face exogenous uncertainty in future market demand, which is in turn characterized by fluctuations in a demand parameter. It shall be assumed a linear inverse demand function of the form:

$$P(Q, \theta_t) = \theta_t - (Q_a + Q_b) \qquad (1)$$

Where θ_t is the demand shift parameter, assumed to follow a multiplicative binomial process, Qa and Qb are the quantities produced by both firms present in the market and P(Q) is the common market price as a function of total quantity (Qa + Qb). The demand shift parameter follows a binomial process and at the next time period it may increase by the multiplicative factor, u, or decrease by the multiplicative factor d[1].

With this evolution in time of the demand parameter, the value of the firm at the end node of the demand tree can easily be computed. The end node of the tree shall also be considered as the maturity date

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[1] The multiplicative factors, u, d, are exogenous to the model but the relationship between them is in accordance to the standard relationship established in binomial processes. The probabilities associated with such movements are the actual probabilities. The multiplicative factor, u, has probability q, and the multiplicative factor d, has complementary probability (1-q).

of the options and the maturity date of the debt outstanding. However, it is necessary to obtain the value of the firms without including the decisions to be taken by the firms considering the exercise of the options and the debt payment. In order to do so, we must derive firm value under the equilibrium alternative to be considered, Cournot-Nash.

The total variable production cost for a particular firm i (i = A or B) is given by:

$$C(Q_i) = c_i Q_i + \frac{1}{2} q_i Q_i^2 \qquad (2)$$

Here, ci and qi are the linear and quadratic cost coefficients. Therefore, the annual operating profit for each firm is given by:

$$\begin{aligned} \pi_i(Q_i, Q_j, \theta_t) &= P Q_i - C(Q_i) \\ &= [(\theta_t - c_i) - Q_j] Q_i \\ &\quad - \left(1 + \frac{1}{2} q_i\right) Q_i^2 \end{aligned} \qquad (3)$$

The value of the firm, assuming perpetual annual operating cash-flows thereafter, corporate tax τ, and a constant risk-adjusted discount rate κ, is given by:

$$V_i = \frac{\pi_i}{\kappa}(1 - \tau) \qquad (4)$$

In order to obtain the reaction function of each firm under quantity competition it is necessary to maximize each firms profit function over its own given quantities. Each firm reaction function is thus:

$$R_i(Q_i) = \frac{\theta_t - c_i - Q_j}{2 + q_i} \qquad (5)$$

Since both firms equally share the market, they achieve Cournot-Nash equilibrium. The equilibrium quantities are obtained by equating both reaction functions. The end result is:

$$Q_i^* = \frac{(\theta_t - c_i)(2 + q_i) - (\theta_t - c_j)}{(2 + q_i)(2 + q_j) - 1} \qquad (6)$$

Simplifying the above expression, by setting $q_i = q_j = 0$, we obtain the following expression for the quantities:

$$Q_i^* = \frac{\theta_t - 2c_i - c_j}{3} \qquad (7)$$

These equilibrium quantities generate the following firm value:

$$V_i^* = \frac{(\theta_t - 2c_i + c_j)^2}{9\kappa}(1 - \tau) \qquad (8)$$

Having derived firm value under Cournot-Nash equilibrium, it is now time to include managerial flexibility. That is represented by the possibility to expand the scale of operations, exercising the growth option, and by the possibility to abandon the market, exercising the abandonment option.

We shall start with the consideration of a growth option to expand its scale of operations. This type of option is typically assumed as an increment in firm value in exchange of the investment expenditure necessary to implement it. Therefore, it is like a call option on the increment in firm value with an exercise price equal to the investment expenditure necessary to implement it. The payoff at expiration date, for a call option with these characteristics can be represented by:

$$G = Max(gV - I, 0) \qquad (9)$$

In the expressions above, I represents the additional investment outlay necessary to expand the scale of operations, G represents option value and gV represents the increment in the value of the firm. With the terminal value for the call option on the cash flows of the project above derived, the value of such option at a particular time is obtained by the general binomial valuation model of a call option:

$$G_{t-1} = \frac{[puG_t + (1-p)dG_t]}{(1+r)} \qquad (10)$$

And with p, the risk neutral probability, being equal to:

$$p = \frac{\left[(1+r) - \left(\frac{\kappa}{1+\kappa}\right) - d\right]}{u - d} \qquad (11)$$

In the above expression, $\kappa/(1+\kappa)$ represents the constant asset (dividend like) payout yield for a perpetual project (or firm). If we extend this single period binomial model and subdivide the time to expiration of the growth option, T, into n equal subintervals, each of length $t = T/n$, the general binomial pricing formula can be represented as follows:

$$G = \frac{\sum_{j=0}^{n}\left\{\frac{n!}{j!(n-j!)}\right\}p^j(1-p)^{n-j}Max(u^j d^{n-j}gV - I, 0)}{(1+r)^n} \qquad (12)$$

This expression adds the probability that the firm will take j upward jumps in n steps, each with risk neutral probability p. These jumps are in accordance with the evolution of the demand parameter considered in the demand function.

It is now time to include the valuation methodology for the abandonment option. This type of option is typically assumed as a put option on the assets of the firm for the salvage value specified. The payoff at expiration date, for a put option with these characteristics can be represented by:

$$A = Max(X - V, 0) \qquad (13)$$

In the expressions above, X represent the salvage value at which the firm can be abandoned, A represents option value and V represents the value of the firm.

With the terminal value for the put option on firm value above derived, the value of such option at a particular time is obtained by the general binomial valuation model for a put option:

$$P_{t-1} = \frac{[puP_t + (1-p)dP_t]}{(1+r)} \qquad (14)$$

If we again extend this single period binomial model and subdivide the time to expiration of the growth option, T, into n equal subintervals, each of length $t = T/n$, the general binomial pricing formula can be represented as follows:

$$A = \frac{\sum_{j=0}^{n} \left\{ \frac{n!}{j!(n-j!)} \right\} p^{j} (1-p)^{n-j} Max\left(X - u^{j} d^{n-j} V, 0\right)}{(1+r)^{n}} \qquad (15)$$

This expression also adds the probability that the firm will take j upward jumps in n steps, each with risk neutral probability p. Once again, such probability is in accordance with the demand parameter considered initially.

With the two managerial possibilities present, it is now the time to develop the value of the firm after such flexibility is incorporated in the firm values derived. It results from the value of the firm obtained in accordance to the market equilibrium defined, without consideration of flexibility, with the addition of these two managerial possibilities the firm possesses. At the maturity date of the options, the value of the firm with the addition of the growth option is given by:

$$V^{G} = V + Max\left[(g-1)V - I, 0\right] \qquad (16)$$

This is equal to:

$$V^{G} = Max\left[gV - I, V\right] \qquad (17)$$

At the maturity date of the options, the value of the firm with the addition of the abandonment option is given by:

$$V^{A} = V + Max(X - V, 0) \qquad (18)$$

This is equal to:

$$V^{A} = Max(X, V) \qquad (19)$$

Therefore, the value of the firm results from the initial value of the firm and these two managerial possibilities the firm possesses. At the maturity date of the options, it is given by:

$$V^{GA} = Max(V, gV - I, X) \qquad (20)$$

By substituting firm value as in the different market equilibriums considered, we obtain the value of the firm under Cournot-Nash as:

$$V^{C} = Max\left(\frac{(\theta_{t} - 2c_{i} + c_{j})^{2}}{9\kappa}(1-\tau), g \frac{(\theta_{t} - 2c_{i} + c_{j})^{2}}{9\kappa}(1-\tau) - I, X \right) \qquad (21)$$

The value of the firm with the managerial flexibility present at a date prior to the expiration date of the options considered follows a similar path to the

one described for the value of the options when considered in isolation. Therefore, it can be computed as follows:

$$V^{GA} = \frac{\sum_{j=0}^{n} \left\{ \frac{n!}{j!(n-j!)} \right\} p^{j} (1-p)^{n-j} Max\left(u^{j} d^{n-j} V, u^{j} d^{n-j} V + g u^{j} d^{n-j} V - I, A\right)}{(1+r)^{n}} \qquad (22)$$

After this computation, it is necessary to incorporate the agency conflicts that result from the additional equity issue necessary in order to exercise the growth option. Under the consideration that the firm is financed by both equity and debt, the total current market value of the firm, V, is the sum of the market value of the two securities. Therefore,

$$V = E + D \qquad (23)$$

Where E represents the market value of equity and D represents the market value of debt. Under this scenario, equity can be seen as a call option on the

assets of the firm. The exercise value of such call option is the value of outstanding debt. The maturity of this option is the maturity of the debt. Under the present setting, such maturity date is the same as the maturity date of the options considered. Therefore, the general value for the equity of the firm at debt maturity can be represented as follows:

$$E_{T} = Max(V_{T} - F, 0) \qquad (24)$$

In this expression, F represents the face value of debt outstanding while ET and VT represent the

equity and firm value at the maturity date of debt. Being a call option on the assets of the firm, the value

$$E = \frac{\sum_{j=0}^{n} \left\{ \frac{n!}{j!(n-j!)} \right\} p^{j} (1-p)^{n-j} Max\left(u^{j} d^{n-j} V - F, 0\right)}{(1+r)^{n}} \tag{25}$$

Furthermore, the value of debt can be obtained by deducting to the value of the firm, the value of the equity. Alternatively, it can be computed as the difference between the value of the firm and the value of a call option on the assets of the firm with an exercise price equal to the face value of debt outstanding. Therefore, it can be given by:

$$D = \frac{\sum_{j=0}^{n} \left\{ \frac{n!}{j!(n-j!)} \right\} p^{j} (1-p)^{n-j} \min\left(u^{j} d^{n-j} V, F\right)}{(1+r)^{n}} \tag{28}$$

This is the general model that will be used to obtain the market value of the firm as well as the market value of equity and debt. However, with the inclusion of managerial flexibility and consideration of debt financing, we get additional results for equity and debt value under the different market equilibriums considered.

In the presence of Cournot-Nash equilibrium without managerial flexibility, and applying Eq. (8) into Eq. (24), we get the expression for equity value as:

$$E^{C} = Max\left(\frac{\left(\theta_{t} - 2c_{i} + c_{j}\right)^{2}}{9\kappa} (1-\tau) - F, 0 \right) \tag{29}$$

of equity at any date before the maturity date of the debt contract, can be estimated as:

$$D_{T} = V_{T} - Max\left(V_{T} - F, 0\right) \tag{26}$$

The end result of this perspective is:

$$D_{T} = \min\left(V_{T}, F\right) \tag{27}$$

The present value of this terminal value is obtained by the following expression:

And applying Eq. (8) into Eq. (27), we get the expression for debt value as:

$$D^{C} = \min\left(\frac{\left(\theta_{t} - 2c_{i} + c_{j}\right)^{2}}{9\kappa} (1-\tau), F \right) \tag{30}$$

When in the presence of managerial flexibility, the expressions for the value of the equity and for the value of the debt can be obtained by substituting Eq. (21) into Eq. (24) and Eq. (27):

$$E^{C} = Max\left[Max\left(\frac{\left(\theta_{t} - 2c_{i} + c_{j}\right)^{2}}{9\kappa} (1-\tau), g \frac{\left(\theta_{t} - 2c_{i} + c_{j}\right)^{2}}{9\kappa} (1-\tau) - I, X \right) - F, 0 \right] \tag{31}$$

$$D^{C} = \min\left[Max\left(\frac{\left(\theta_{t} - 2c_{i} + c_{j}\right)^{2}}{9\kappa} (1-\tau), g \frac{\left(\theta_{t} - 2c_{i} + c_{j}\right)^{2}}{9\kappa} (1-\tau) - I, X \right), F \right] \tag{32}$$

This set of expressions defines the model implemented in the present research. Additionally, the insight that determines the agency cost of debt is that two different policies shall be considered in order to exercise the growth option. The first-best policy

considers that such option will be exercised in order to maximize the value of the firm. The second-best policy considers that such option will be exercised in order to maximize the value of the equity of the firm.

The difference in firm value that results from these two different policies is the agency cost of debt.

For the first-best policy, the expressions are already derived, since they correspond to the maximization of firm value. Therefore, they are in accordance with the expressions derived for firm value. However, for the second-best policy, it must be noted that the expressions that were derived for the value of the equity of the firm do not correspond to the decision to be taken by firms that execute the second-best policy. The expression derived for the equity value corresponds to the value of equity that results from the maximization of firm value. It is not the maximization of equity value. Therefore, an expression for the maximization of equity value must be derived. The exercise of the option maximizes the equity value if firm value after exercise minus the value of debt outstanding and the value of the additional equity issue is higher than the value of the firm without exercise of the option minus the value of the debt outstanding. Under this premise, equity guarantees that the additional equity issue is not appropriated by the original debt. Therefore, the wealth transfer does not occur. Therefore, firm value under the second best policy can be derived from:

$$V_T = \begin{cases} gV - I & , gV - 2I - F \geq V - F \\ V & , gV - 2I - F < V - F \end{cases} \qquad (33)$$

With this policy, derivation of firm value in the different market equilibriums reached is obtained by the straightforward procedure of substituting the expressions for firm value in Eq. (33). The equity and debt values are also obtained by the incorporation of the firm value obtained in the expressions previously derived for the equity and debt value. With the model fully described it is now the time to implement it. In the next section we shall perform a numerical simulation of the model constructed in order to analyse the results achieved with it.

3.2.   Results

The implementation shall be made with a numerical analysis performed through a simulation of a set of parameters. We shall start by the definition of all the necessary parameters to perform such simulation, after that we shall proceed to the numerical analysis ending with the main conclusions to be withdrawn from the analysis made.

3.2.1   Parameters

The numerical analysis to be performed assumes a duopolistic market where both firms share a growth option to expand the scale of operations and an abandonment option. Both firms have equal operating costs and it is further assumed, initially, that both firms will have identical financing structures and both firms will finance the growth option in equal form (through an additional equity issue). The necessary parameters in order to implement the model are the following:

Table 1. Parameters

Parameter	Value	Parameter	Value
$\theta 0$	17.50	Ca	5.00
u	1.25	Cb	5.00
d	0.80	F	50.00
rf	2.000%	X	0.00
κ	8.000%	g	3.00
τ	25.000%	I	50.00

This set of values is an adaptation of the set of values that were present in Smit and Trigeorgis (2004). Furthermore, some additional values were adjusted to the present market and legal conditions. With this set of values, we shall proceed to the valuation of the firm.

3.2.2   Results

Under the scenario without flexibility we get the following values for the value of the firm, its equity and its debt:

Table 2. Results

Parameter	Value	Parameter	Value
Va	118.49	Vb	118.49
Ea	84.67	Eb	84.67
Da	33.82	Db	33.82

With the inclusion of flexibility under the first-best policy, the values for the firm, its equity and its debt are naturally higher due to the existence, and

exercise of the operational flexibility. They are presented below:

Table 3. Results

Parameter	Value	Parameter	Value
Va	317.03	Vb	317.03
Ea	279.52	Eb	279.52
Da	37.51	Db	37.51

It must be referred that with the adoption of the growth option, the value of the debt increases significantly, 10.89%. The wealth transfer effect mentioned in the literature is also present in this formulation. The growth option is financed by an additional equity issue, but part of the benefits from such additional equity issue is transferred to the debtholders of the firm.

In order to prevent such transfer of value, management adopts a second-best strategy. Under this strategy, the adoption of the growth option is determined by the maximization of the equity value of the firm and not by the maximization of firm value. The results achieved under this strategy are presented below:

Table 4. Results

Parameter	Value	Parameter	Value
Va	305.91	Vb	305.91
Ea	272.08	Eb	272.08
Da	33.82	Db	33.82
Ea (additional)	18.49	Eb (additional)	18.49

It is clear from the above table that the value of the firms diminishes compared to the first-best policy firm value. The decrease in value is of 3.51% when compared to firm value with the adoption of the first-best policy. This decrease represents the agency cost of debt as a result of an underinvestment in the growth option, consequence of the change in the strategy adopted to exercise it. The value of the debt decreases to the initial debt value (in the scenario without flexibility), becoming this way clear that debt is not benefited from the additional equity issue. The value of the equity also diminishes, when compared

to the one obtained under the first-best policy. However, the "savings" in the additional equity issue possess a present value of 18.49. This reduction in the equity issue necessary to exercise the growth option is an increase in the value to the equity (in a global perspective, including the initial equity and the additional equity issue) that largely compensates the loss originated from the reduction in the exercise of the growth option under the second best policy. The computation of this additional value is necessary in order to establish the difference between the two policies considered. In fact, by adopting the second-best policy, the firms exercise the growth option in a reduced number of branches of the demand tree. Therefore, the comparison between firm values in the two policies considered needs to include the additional investment in which the firms incur by adopting the first-best policy in comparison to the adoption of the alternative policy.

The results obtained under Cournot-Nash clearly show that under the premises assumed, the agency cost exists and is significant. It leads to a reduction in the value of the firm as a consequence of the underinvestment situation caused by the adoption of a second-best policy. These results, under this equilibrium perspective are identical to both firms, since they equally share the market.

4.   Conclusions

The economic environment that firms face is in constant transformation. At the present, such economic environment is characterized by higher operational (managerial) flexibility, competition and lack of liquidity in financial markets. This is the result of an increased globalization of the economy and of the crisis that affected financial markets. These events affect managerial decisions, particularly the ones related to capital budgeting. Therefore, a research conducted for the analysis of capital budgeting decisions under these new economic setting is extremely relevant in order to develop the current literature on the subject and to improve professional practice. This is the first conclusion to be withdrawn from the present dissertation. With the integration of three different theories into a unified perspective we aimed at an enhancement in the knowledge related to capital budgeting under competition and managerial flexibility, in the presence of agency conflicts between equity and debt. Such enhancement contributes to improved managerial decisions and therefore to added value in corporations.

In order to achieve it, we departed from a general approach to the problem through an analysis conducted on the fundamental literature on the subjects. The model developed was presented, describing the assumptions under which it was constructed. Later still, a numerical solution was implemented through a simulation set that enabled the extraction of results for analysis.

In order to clarify the main results achieved, these are separated between reflections about the model itself and considerations about the outcomes of the numerical simulation implemented. Finally, remarks regarding future possibilities of research will be presented.

The model developed departed from two previous works, one that integrated agency conflicts with ROA (Mauer and Ott, 2000), and another one that integrated ROA and competition (Smit and Trigeorgis, 2004). The first was in continuous-time and the second in discrete-time. Despite the widespread use of continuous-time models, we adopted the discrete-time perspective. This decision was based in the higher practical application of this type of models. In fact, the literature refers that one factor that might pose a barrier to the widespread use of real options models in corporation is the complexity continuous-time models possess. Therefore, the adoption of a discrete-time model can overcome such difficulty. On the other hand, models that analyse the interaction between investment and financing decisions tend to consider debt as "perpetual", in the sense that the rollover of the initial debt issue is considered feasible, and continuous-time models are best suited for such assumption. The model developed in the present dissertation does not consider so. In fact, due to the current situation of financial markets we opted to assume that the initial debt issue must be repaid at its maturity date. This assumption reinforced the possibility to develop a discrete-time model, since under these models it is necessary to establish a maturity for the options present. Therefore, the analysis developed gains in tractably, is best suited for adoption in real life practice and is more in accordance to actual conditions in financial markets.

The equilibrium conditions largely rely on the model developed by Smit and Trigeorgis (2004). The equilibrium defined is in line with Cournot Equilibrium and is, therefore, well established in the literature. The simulation performed intended to define a set of conditions that enables the achievement of results from implementation of the model. That simulation allowed us to understand better the managerial decisions taken under the set of conditions defined. In fact, concerning a competitive market with a shared growth option in which firms face agency conflicts between equity and debt, the model attempted to illustrate the decisions that firms should take. The results, for the numerical simulations developed, are conclusive.

It became clear that under Cournot-Nash equilibrium an incentive to underinvest exists whenever the firm is financed by both equity and debt, and the growth option is financed solely by equity. A wealth transfer occurs between equity and debt. The solution to avoid such wealth transfer is to delay investment in the growth option, which generates a reduction in firm value. This reduction in firm value is the agency cost of debt.

The path followed opens a different perspective of research in this field. In fact, the model constructed can easily be reformulated to incorporate other possibilities besides the ones considered. Namely, the possibility of consideration of other forms of financing is open wide. In fact, consideration of alternative financing structures for the firms or for the exercise of the growth option is a logical and natural step. We replicated the financing conditions present in Mauer and Ott (2000). A replication of the financing conditions present in Mauer and Sarkar (2005) is a useful step that will generate relevant conclusions for this field of research. It can also be analysed the use of instruments of debt that could mitigate the agency conflicts present, namely callable or convertible debt instruments.

Alternatively, other forms of equilibrium could also be analysed. In fact, the adoption of the Cournot equilibrium conditions was justified with the adoption of the assumptions present in Smit and Trigeorgis (2004). Nonetheless, other possibilities do exist that could be studied. A Bertrand price competition is a logical development, as well as Stackelberg equilibrium also in line with the developments in Smit and Trigeorgis (2004).

Empirical testing of the present findings is another path that can be followed for the future. In fact, the testing of the present model could be made by its verification on oligopolistic sectors where innovation is present. Under ROA, empirical analysis is not yet very widespread. However, the validation of theoretical findings has a lot to gain with its

empirical confirmation. The theoretical findings reached in this research are no exception.

The present research allowed the determination of the equilibrium conditions that might be present in competitive markets with shared growth options and abandonment options under agency conflicts between equity and debt. The comprehension of the factors that affect managerial decisions under these conditions is far from being reached, even because other aspects besides the ones here analysed interfere with those decisions. However, the breakthrough achieved in this research is one more step in the knowledge of those decisions.

Acknowledgements

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Remote Channels as an Opportunity in Redesigning Portuguese Banks' Business Model – an Empirical Study in Lisbon Metropolitan Area

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Abstract - **Facing an unfavorable economic environment since 2007 the Portuguese banking sector has been unable to generate profitability levels capable of ensuring the industry's attractiveness to investors. The solvency adequacy measures required by regulatory authorities forced the paradigm change in the banking business model. The widespread diffusion of technological innovation in Portuguese society enhances the use of remote banking access channels such as internet banking service (IB) and the ATM, while the traditional branch channel usage is decreasing. A study conducted in the Lisbon area, with 191 responses obtained, revealed that the channels with greater usage intensity are the ATM and IB. It further revealed that there are behavior dimensions on the IB use with direct effect on customer retention. Satisfaction with IB service, perceived switching costs and favorable price perception affect customer retention in their IB service. The findings of this research also confirm that satisfaction with IB service and perceived service price have a direct effect on repurchase intention.**

Keywords - Portuguese banking sector, internet banking, remote channels, self-service technologies.

1.   Introduction

Following the economic and financial crisis the Portuguese Banking System (PBS) return on equity (ROE) decreased about 76% when compared to the values prior to the crisis, which has been penalizing the sector's attractiveness to investors. Factors such as the funding difficulty of the banking system in the international markets, the increase in credit and default risk and the deterioration in consumer confidence level aggravated the scenario in which the sector develops its activity. The inevitable demand for a deleverage process of the sector under the Economic and Financial Assistance Plan (PAEF) aimed to ensure greater stability in the banking system and established demanding capital ratios and goals.

The objective in PAEF set a credit-deposit ratio of 120% by the end of 2014, a 25% decrease over the present value, and a core Tier 1 capital of 9% and 10% at the end of 2011 and 2012 respectively.

Given the paradigm change, banks are required to revisit their business models. Models fundamentally based on credit have been converted into models focused on customer assets which represent a more stable funding source and in turn allow the sector to become less dependent on the financial markets. This trajectory to a "back to basics" model encounters various difficulties, especially within a stressed economy environment and in a context of widespread deterioration of the labor market and consumer confidence.

These demands forced the paradigm change, previously based on credit granting into a model focused on attracting customer assets. Given the decrease in the banking sector's net interest margin and revenue, a new aim on costs has also been explored, for example, involving the downsizing of the branch network. However, there is still a huge potential in exploring the current technological development of the banking network service and existing distribution channels. The cost-to-serve should not be neglected, neither in the cost reduction perspective, nor in the maximization of customer

service alongside the remote channels (internet banking, call center, ATM's, mobile banking) which stand for important distribution channels.

2. Research Objectives

This research aims to ascertain how remote channels may represent an opportunity (becoming a more representative distribution channel) in redesigning the sector's business model (specially within the sector's deleveraging process), alongside with a greater cost efficiency and maximizing customer relationship.

It therefore becomes necessary to identify aspects that influence IB users' behavior in Portugal (for the purpose of this study, based in the context of Lisbon Metropolitan Area) and those that can particularly influence customer retention. Thus, bank managers can, supported by the adequate knowledge of the decisive factors affecting customer behavior, adopt strategies and actions to ensure existing IB customers loyalty towards the service and simultaneously strengthen their customer bases.

3. Literature review

The development of technology is significantly changing service providing based on an earlier paradigm of "*low-tech, high-touch*" (Bitner *et al.*, 2000). Customers are becoming, ever increasingly, fans of self-service technologies (SST), "*customers produce services for themselves without assistance from firm employees*" (Meuter *et al.*, 2005). These are services with different characteristics from those offered by traditional channel (branches), and provide a more convenient access with regards to place and time, and yet, do not involve the personal contact with employees of the branch (Meuter *et al.* 2005).

According to Sathye (1999) internet banking *"involves consumers using the internet to access their bank and account, to undertake banking transactions (…) accessing accounts, fund transfer, and buying financial products or services online"*. Typically, this is a channel with lower pricing, convenience and accessibility advantages *"when they want it and from where they want it"* (Mols, 1998), and provides greater privacy on customer interaction with the bank.

The IB segment (*"internet banking segment"*) consists of customers who do not value personal relationships with their bank, with higher academic qualifications and belonging to upper and middle classes (Mols, 1999).

Various aspects such as convenience (available 24 hours a day, 7 days a week), quick access (loading sites), ease of use, trustworthy information, perceived usefulness, ease of use, perceived risk (security, confidentiality and privacy in the use of IB), strengthening security, lower operation costs, easier access to product information and price, product purchase convenience of associated services are the most valued attributes by customers and that most affect IB adoption (Liao and Cheung, 2002; McKinsey, 2011; Yiu *et al.*, 2007; Porter, 2001).

On the other hand, in the perspective of banks, advantages include lower selling costs per transaction, since the costs of an electronic transaction are six times less than its manual processing (Kalacota and Freire, 1997, cited by Proença and Rodrigues, 2011), enhanced access to markets (Porter, 2001) in remote areas throughout the country and therefore with less geographic branch coverage.

An internet banking strategy must be defined, integrated in the overall corporate strategy and market positioning. This integration must be carried complementary to approaches through the different channels (and not cannibalizing them) and creating competitive advantages difficult to be matched by competitors (Porter, 2001).

The definition of the mentioned strategy involves investment in the infrastructure and multi-channel systems which integrate the various channels used by clients (McKinsey, 2011), developing CRM (customer relationship management) models integrated into the company value chain (Porter, 2001). Relationship marketing represents an excellent opportunity in the multi-channel context given the potential of approaching each and every client in a personalized way and according to their specific needs and preferences.

The internet boosts competitive rivalry among existing industry players and reduces barriers to entry (for example the entry of exclusively virtual banks) given the inherent lower investment requirements (Porter, 2001). This author states that the abundant availability of information in the current knowledge society shifts bargaining power to customers. Customers, overall better informed, easily compare products and prices which in turn increases the pressure on the profitability of the sector. Simultaneously, they represent a threat to banks due to the greater potential on customer dropouts (Mols, 2001).

The uncertainty of the technological impact in customer-bank relationship (since the internet allows easy comparison between bank offers), leads to the need for banks to be fully aware of the aspects that influence customer behavior when using remote technologies, namely the IB.

- **Customer retention**

Retention is defined as the future propensity of an IB customer to maintain their current service (Ranaweera and Prabhu, 2003; Wong and Mula, 2009) and is also one of the most important indicators of customer satisfaction (Danesh *et al.*, 2012).

A loyal customer increases overall involvement and business over time, thus increasing the profitability that represents in the firm base (Reichheld and Sasser, 1990). According to these authors, in the banking sector, reducing dropout rates by 5% can represent an increase in profitability by as much as 85%. Additionally, costs of attracting new customers are substantially higher and may represent five to seven times more the period a company needs to spend on attracting new customers when compared to the retention of existing ones (Bhote, 1996 cited by Galbreath, 2002).

Convenience, proximity to home and to the workplace are leading reasons for selecting a bank. Other factors such as maintaining a loan in a bank, domiciling salaries, parents' choice influence, recommendation, service characteristics, interest and commissions / service fees, expectations of service levels and the image and reputation of the bank (Banco de Portugal, 2011; Martenson, 1985; Devlin, 2002; Devlin and Gerrard, 2004) are factors influencing the retention of customers with their banks.

IB users exhibit greater loyalty, greater propensity to recommend their bank, higher repurchase intention and lower price sensitivity (less likely to change to another bank) than non-users, are more prone to place claims, thus granting their current bank the opportunity to promote improvements (Mols, 1998).

There were two items used in the questionnaire measuring propensity to dropout in different time periods: in the next three months and in the next six months (Wong and Mula, 2009).

- **Repurchase intention**

Repurchase intention is defined as the intention to *"repeat purchases over time, and eventually, new products with greater added value for the company"*

(Rodrigues, 2008). If the use of PC banking represents a positive experience with which users perceive a higher added value they will continue to use the service, intending to continue conducting business with their bank in the future and in some cases even increasing it (Mols, 1998).

According to Mols (1998) and Proença and Rodrigues (2011), SST users reveal higher repurchase intentions than non-users. Santonen's (2007) findings reveal that repurchase intention is a crucial component of service loyalty. We will therefore test the following hypothesis:

> H1. For internet banking users the higher satisfaction level, the greater their intention to repurchase.

In this study we used two items validated by Proença and Rodrigues (2011), one of them also present in Santonen's study (2007).

- **Customer satisfaction**

Customer satisfaction is understood as the evaluation of an emotion that reflects the degree to which IB customers believe their service provokes satisfactory feelings (Wong and Mula, 2009). According to Wong and Mula (2009), Danesh *et al.* (2012) and Ranaweera and Neely (2003) the greater the degree of satisfaction, the greater the retention level.

Hallowell (1996) shows there are direct relationships between satisfaction and customer retention and, between retention and profitability. Wong and Mula (2009) also corroborate the relationship between satisfaction and customer retention.

Therefore the following hypothesis will be tested in the Portuguese context:

> H2. For internet banking users the higher satisfaction level, the greater customer retention.

We used the three items listed in the analysis of Wong and Mula (2009) and Ranaweera and Prabhu (2003), one reflecting a more emotional perspective and the other two, a more rational one.

- **Switching Costs**

Switching costs are defined as the perception regarding the magnitude of costs necessary for IB customers to end their current relationship with IB service and ensure an alternative (Wong and Mula, 2009). *"Time, money and your effort, all of these items define switching costs which in result make your perception as difficulty to switch"* (Danesh *et*

al., 2012). They integrate costs of a financial nature, but also resistance and convenience factors as costs of searching for a new service provider, transfer costs, learning needs required for the new service, potential loss of loyalty programs, user habit, emotional adjustment and perception of financial, psychological and social risk (Fornell, 1992).

Given the importance of maintaining the customer base the IB implementation should not neglect the construction of exiting barriers to customers, namely by applying higher switching costs (Sheshunoff, 2000). The author concludes that a client using full service IB complemented with automatic debit orders and scheduled automatic transfers is significantly less prone to exit to another bank.

Customer satisfaction is not the only issue capable of retaining customers in firms (Jones and Sasser, 1995, cited by Danesh *et al*., 2012). Switching costs can also influence customer retention to a large extent. Ranaweera and Prabhu (2003) and Danesh *et al*. (2012) have proved the positive effect of switching costs in customer retention. Wong and Mula (2009) have also validated on IB users that the perceived higher switching costs influence higher retention levels.

We used the same five items indicated by Wong and Mula (2009) (originally withdrawn Ping (1993), cited by the authors). We, therefore, propose an identical hypothesis in the Portuguese context:

> H3. For internet banking users the higher perceived switching costs, the higher the retention levels.

- **Price perception**

Price perception is defined as the customer's perspective regarding value and includes different perspectives: the target price, the perceived price and the perceived sacrifice necessary to get the product / service (Zeithaml, 1988).

Ranaweera and Neely (2003) and Jiang and Rosenbloom (2005) found that price perceptions have a direct effect on retention and on greater repurchase intention. In the banking sector, Varki and Colgate (2001) found that price perception affects customer retention in the service. Therefore, we propose the following hypothesis:

> H4. For internet banking users, the better the price perception,

> a) the higher the repurchase intention.
>
> b) the higher the retention level.

Given the literature reviewed and according to Ranaweera and Neely (2003) only one item was previously validated and consequently, the only one used in this study. Although the internal reliability could not be tested, to the extent that the item is correctly written and consistent with the literature, it results in a valid measure (Ranaweera and Neely, 2003).

- **Price sensitivity**

Price sensitivity is the variable with the greatest impact on the dropout rate of banks (Colgate and Hedge, 2001). This study aims to analyze in which way the use of remote channels, more specifically the IB channel, can mediate the relationship with dimensions that can be controlled by banks to prevent customer dropout such as satisfaction and exiting barriers.

According to Proença and Rodrigues (2011), in the specific case of Portugal, SST users are more price sensitive that non-users, an opposite conclusion of Mols (1998). Santonen (2007) verifies that price sensitivity is related to customer abandonment probability.

In this study three items validated by Santonen (2007) were used, two of them also present in Proença and Rodrigues (2011). Price sensitivity was the only variable measured at bank level and not specifically on the IB service, since this study aims to measure in which way intensity of IB use can:

a) mediate satisfaction and customer price sensitivity on their banking service

b) mediate perceived switching costs and customer price sensitivity on their banking service

Therefore, the sub-universe of IB users that use it as the primary channel and with high intensity, defined in this study as frequent users (heavy users) are faced with these two hypotheses:

> H5. For IB heavy users, the greater the degree of satisfaction, the lower price sensitivity.

> H6. For IB heavy users, the higher the perceived switching costs, the lower price sensitivity.

In summary, the conceptual framework with the hypothesis is the following:
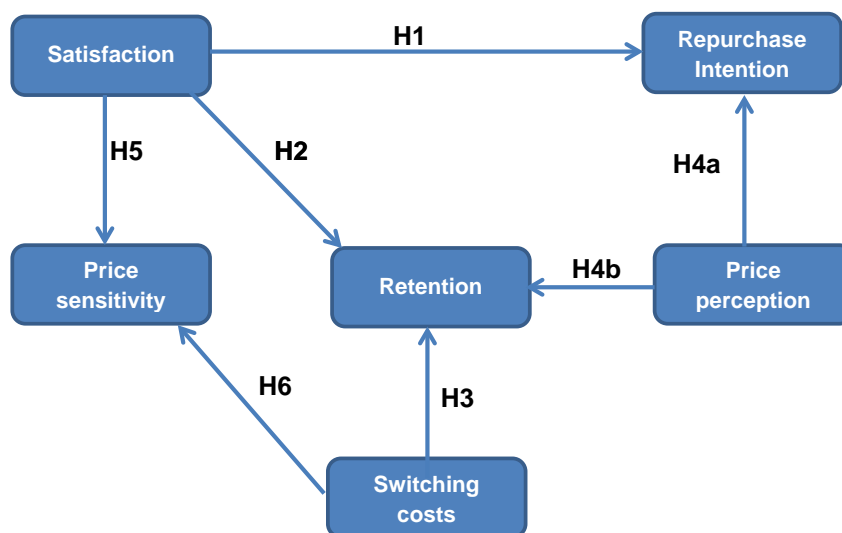
Figure 1 – Conceptual Framework

4.   Portuguese Context

There are 35 banks authorized to operate in the country however around 78% of total assets and liabilities of the banking system is concentrated in 5 banks: Santander Totta, CGD (CGD), BES (BES), Millenium BCP and BPI (Portuguese Investment Bank). In 2011 the total revenue resulting from these banks's activity represented 76% of total PBS' revenue (these banks represent 60% of branches and 66% of employees). The three main virtual commercial banks operating in Portugal are Activo Bank, Banco BEST and BIG. According to data from the APB (2012) its joint share in number of employees is 0.8% and 0,3% in assets and liabilities. Total revenue resulting from their activity in 2011 accounted 0.7% of total PBS.

This model will have to be adjusted to a more focused, knowledgeable and demanding universe of customers and seize less explored opportunities in customer service. Remote channels may represent an opportunity (becoming an ever more representative distribution channel) on the redesigning of the sector's business model in line with greater cost efficiency and maximizing customer relationship.

The number of Internet users in Portugal has undergone a significant growing trend. In 2002, 19% of the population in the age group of 16 to 74 used the internet and 10 years later that figure almost tripled (55%) (INE, 2011).

Even though there are concerns with regards to security issues (52% of individuals who use internet are concerned with potential security issues such as phishing or a fraudulent use of a payment card) (INE

online, 2012) the number of IB customers in 2011 totaled 2.2 million, triple the value compared to 2003 (Marktest, 2011). The IB penetration rate in Portugal in 2011 was roughly 22% and since 2003 has had an average annual growth rate of about 18% (Eurostat online, 2012). In 2011, the proportion of IB users within the Portuguese internet users, rose to 40% (INE online, 2012), twice the IB penetration rate in Portugal.

Regarding the Portuguese IB non-users, the preference for automatic teller machines (ATM) is indicated as the main reason (27%) for not subscribing this channel, followed by difficulty in dealing with technology (19%), lack of confidence in the service security (19%), lack of a regular access to the internet (18%), and the preference for direct contact with the branch (15%).

The average number of channels used to contact the main bank is of utmost importance since customers using multiple channels demonstrate twice the loyalty compared to customers who only use the branch to interact with the bank (McKinsey, 2011).

According to Marktest (2011) ATM machines are the preferred means by which customers contact their main bank, totaling about 5.9 million Portuguese users. The second preferred means is through personal contact, however branch use has been decreasing. IB is the third most common form of contact used by customers.

5.   Methodology

The dimensions reviewed in the literature and used in this study were measured by means of a

questionnaire using a 5-point Likert scale (where 1 - strongly disagree and 5 - strongly agree, 1 - very unlikely and 5 - very likely) and based on literature where the internal consistency of items was duly validated.

The questionnaire was divided into three parts. The first part collected socio-demographic data. In the second part of the questionnaire it was intended to determine which remote channels are used by customers to access their bank accounts, the use frequency and the involvement level with the specific channel of IB. For IB non-users it was questioned the main reason for non adoption in order to ascertain the aspects influencing resistance to this channel. These respondents did not accede to the next phase of the questionnaire.

In the last part of the questionnaire it was asked respondents' opinion on a set of items to assess their experience and behavior towards the use of IB service with regards to constructs of satisfaction, perceived switching costs, price perception (with IB service), price sensitivity (with the bank), repurchase intention and retention.

Closed questions were used to ensure uniformity of responses and the subsequent facilitation of the statistical analysis work.

The questionnaire was pre-tested on five people, somes changes were made and then it was sent by email and made available over the internet. 191 valid responses were obtained.

6.   Results

The sample is characterized by individuals, mostly male (54%) aged between 25 and 54 years (86%), mostly married or in a marital equivalent situation and with a degree or higher academic level. 92% of respondents are employed, mainly employees with a monthly net income ranging between 1,000 € and 2,500 €

All 191 respondents are bank customers and stated working with one or more banks.

Considering the frequency of use, results showed that mobile banking, telephone banking (via call center) and contact with the branch via phone or email are the least used channels. The branch seems to be the fourth less used channel having no effect regarding frequency of use when transactions such as depositing and withdrawals are excluded.

The channels most used are ATM and IB (the latter being the channel with largest daily use).

It was possible to estimate an average number of 2.40 channels used representing a slightly lower level of multi-channel usage compared to the figure registered in Europe, 2.60 (McKinsey, 2011).

The most frequent combination of channels used was ATM and IB (26% of sample), only IB (12%), branch, ATM and IB (11%) and only ATM (10%).

Regarding the involvement with IB and where specifically used as a form of contact with the main bank, 12% use it as the exclusive channel to access their accounts and 65% of respondents accumulates IB with other channels adopting a multichannel behavior.

The duration of the relationship expresses loyalty levels given that 75% of IB users have maintained a relationship with their main bank for more than two years (50% of which over more than five years). According to Proença and Silva (2007) the duration and continuity of the relationship between customer and bank influences IB use.

Among non-users of IB (31 respondents) the most frequent reason for not using the service is the preference for the use of ATM followed by the lack of confidence in the channel's security (in line with the literature reviewed, the perceived risk by non-users is considered a barrier to the adoption of this channel).

On average, respondents are moderately satisfied, do not perceive switching costs as high (which implies greater risk of dropout) and consider the service price as appropriate. They do not intend to quit the service but are sensitive regarding the prices charged by the bank and are prone to change due to bank fees and commissions charged.

A factor analysis was employed to confirm the underlying structure of the constructs. The Cronbanch's alpha method was used to estimate the internal consistency. The values obtained range from a minimum of 0.609 (poor but acceptable) for the satisfaction dimension (with IB service) and a maximum of 0.922 (excellent) for retention (in IB service). The results of internal consistency values followed Hill and Hill (2005) grade.

The results of those analysis confirmed both reliability and validity of the measures validated in literature and used in this study.

Table 2 – Reliability test of the constructs of Internet Banking (Cronbach's Alpha)

	Cronbach's Alpha	Nr. of items
Satisfaction	0,609	3
Switching costs	0,648	5
Repurchase intention	0,688	2
Retention	0,922	2
Price sensitivity	0,748	3

Table 1 – Correlation Coefficient Marix for constructs

		Satisfaction	Switching Costs	Repurchase	Retention	Price Sensitivity
Satisfaction	Pearson Correlation	1				
	Sig. (2-tailed)					
	N	160				
Switching Costs	Pearson Correlation	,101	1			
	Sig. (2-tailed)	,206				
	N	160	160			
Repurchase	Pearson Correlation	,530**	,116	1		
	Sig. (2-tailed)	,000	,144			
	N	160	160	160		
Retention	Pearson Correlation	-,170*	-,194*	-,209**	1	
	Sig. (2-tailed)	,032	,014	,008		
	N	160	160	160	160	
Price Sensitivity	Pearson Correlation	,050	-,243**	,048	,174*	1
	Sig. (2-tailed)	,526	,002	,549	,028	
	N	160	160	160	160	160

**. Correlation is significant at the 0.01 level (2-tailed).*

. Correlation is significant at the 0.05 level (2-tailed).

			Satisfaction	Switching Costs	Repurchase	Retention	Price Sensitivity	Price perception
Spearman's rho	Price perception	Correlation Coefficient	,320**	,130	,347**	-,198*	-,140	1,000
		Sig. (2-tailed)	,000	,101	,000	,012	,076	
		N	160	160	160	160	160	160

. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).*

For a significance level (α) of 0.01 there is significant statistical evidence of a strong positive relationship between satisfaction with the IB service and repurchase intention (r = 0.530). This result is consistent, in the context of IB users in the Lisbon Metropolitan area, with Mols (1998) and Santonen (2007) studies.

Satisfaction with IB service relates poorly and inversely with retention (r = -0.170). This negative relationship is due to the fact that the questionnaire items which measured retention inquired about the likelihood of current service dropout, where 1 = very unlikely and 5 = very likely. In accordance with Wong and Mula (2009), Danesh *et al.* (2012),

Ranaweera and Neely (2003), there is a direct relationship between greater satisfaction and less likelihood of customer dropout.

There is a weak negative relationship between perceived switching costs and retention in the IB service (r = -0.194). As in Ranaweera and Prabhu (2003), Danesh *et al.* (2012) and Wong and Mula (2009), results confirm the effect of switching costs in customer retention (implying a lower probability of dropout).

There is a direct and moderate relationship (rho = 0.347) between perceived price and repurchase intention. Moreover, there is a weak negative relationship between perceived price and retention (rho = -0.198), statistically significant (sig. ≤ 0.05). Therefore like Ranaweera and Neely (2003), Jiang and Rosenbloom (2005) and Varki and Colgate (2001), price perception of IB service has a direct effect on repurchase intention and less likelihood of customer dropout.

There is a weak negative relationship between satisfaction with IB service and price sensitivity to the price charged by the bank (r = -0.068), but not statistically relevant (sig.> 0.05), thus not confirming H5. The intensity of IB use does not moderate the effect between satisfaction and sensitivity to the price charged by the bank.

There is a weak negative relationship between perceived switching costs and sensitivity to the price charged by the bank (r = -0.212). There is a relationship between perceived switching costs and lower price sensitivity among customers who use IB intensely ("often" and "every day"). It thus confirms H6.

7.   Conclusions

The banking sector is in a deleverage process being the credit the main component of the balance sheets, and also the main component of the sector's profitability. The PBS return on equity (ROE) decreased about 80% penalizing the sector's attractiveness to investors.

This combined effect has led to the deterioration of net interest revenue. In order to boost results, alternatives presented to banks are, on one hand, generate income from fees and commissions through a differentiated offer capable of retaining and extract value from a broad base of customers, and on the other, reduce their costs.

The capacity reduction has been one aspect of the strategy to reduce costs. However, there is enormous potential inherent to the access of banking services through remote channels, since the cost of an electronic transaction is six times less than the equivalent manual process (Kalacota and Freire, 1997, cited by Proença and Rodrigues, 2011). Relationship marketing can capitalize frequent and proactive access by customers through these channels, with a low cost targeted and personalized communication. Additionally, with reduced physical presence, these channels enable contact with a much wider market not otherwise possible through the branches.

Technological evolution is reflected in the behavior pattern of the Portuguese people, who increasingly adhere to internet-based and self-service technologies. This use on a self-service basis is reflected in the banking channels preferences evidenced by customers: ATM and IB are the fastest growing channels and the traditional channel (branch) shows the opposite trend.

Given the inevitability of a customer market with preference for remote channels, internet banking should be integrated in the overall corporate strategy and market positioning. According to Porter (2001) this integration must be carried out complementing approaches through different channels (and not cannibalizing them), creating competitive advantages hardly matched by the competition.

The study conducted in the metropolitan area of Lisbon, with 191 responses obtained, concluded that the channels with greater intensity of use are ATM and IB, being the branch, telephone banking, mobile banking and contact by e- email / phone with the branch the ones less used. The findings also suggest that there are variables on the behavior use of IB influencing the intention to continue with the service. The greater the satisfaction with the service, perceived switching costs and favorable perceived price, the more likely customer retention in IB service. It was also found that repurchase intention is positively influenced by customer satisfaction and perception of the service price.

For customers with intensive use of IB service results showed that the greater the exiting barriers perceived by these customers, the lower the sensitivity to prices charged by the bank. However, it was further found that no relationship exists between the satisfaction degree of those customers with IB service and their price sensitivity.

With adequate knowledge of the decisive factors in the behavior of customers using remote channels, banks should adopt measures and strategies to ensure the maintenance of existing customers and increase focus on attracting new ones.

From a management point of view, banks should promote the use of remote channels due to the advantages they mutually represent to customers and banks, establishing differentiating factors that ensure competitive advantage, and as such, may lever its business model.

8. Managerial implications

The study findings suggest that the use of channels to access banking services has been suffering changes. The number of customers accessing the traditional distribution channel has decreased, while remote channels assume higher expression as a means of contact. The most used channels are ATM and IB (the latter being the channel with largest daily use).

From a management point of view, banks should enhance CRM namely through a relationship marketing approach which offers the advantages of a personalized and low cost communication, in order to extract value from the frequent and proactive use of remote channels by their customers.

The average number of channels used by customers in Lisbon is 2.4 (2.6 in Europe), therefore the multichannel behavior should be considered by banks incorporating remote channels in the overall distribution and market positioning strategy. This aspect is of great importance since customers using multiple channels demonstrate twice the loyalty comparing to customers who only use the branch (McKinsey, 2011). That integration should ensure that communication to customer is unified regardless of the channel used.

With regards to IB service, although users in Lisbon metropolitan area do not express intention to abandon the service, there are some perceived factors which influence the service continuity intention. For IB users in Lisbon area, the higher the satisfaction level, the higher repurchase intention and greater intention to remain in the current service. Banks can control indicators that measure satisfaction, for example, through satisfaction questionnaires and customer quality controllers adopting corrective measures, if necessary.

Since perceived switching costs affect retention, banks can personalize the service and distinguish it from the competition, so that customers who consider switching service may identify a potential loss. Since the emotional aspect of switching costs is valued by 79% of the respondents (who agree that having to change their service would be disappointing), the approach of a personal contact, through a branch manager for example, can reinforce this exiting

barrier. This is also true for heavy users of IB service since the higher the perceived switching costs, the lower the sensitivity to price charged by the bank.

Given that price perception has a positive effect on repurchase intention and retention, banks should adopt a communication strategy that demonstrates the financial benefits of the service, building a proper price image among customers.

The security issues concerning the IB channel are indicated as one of the main reasons for not using it and it is seen as a disadvantage by users, so banks should strengthen security mechanisms in virtual access (stronger passwords, matrice cards held by customers for validation of transactions). Banks that position themselves differently in this aspect referred in all IB related studies will achieve a competitive advantage over competitors.

9. Limitations and future research directions

Given that the empirical study focused on bank customers in the region of Lisbon, the results obtained in this investigation are limited to the sample. Future studies should consider more representative universes in other Portugal regions in order to obtain findings for the whole Portuguese context.

Future studies should also consider other forms of inquiry, not limited to the use of the internet. The dimensions that analyzed customer behavior emphasized some of the important aspects of user experience of channels supported by remote technologies. However, there are other dimensions that can be explored in the future such as word-of-mouth, complaints behavior, aspects valued by customers not covered by current service, sensitivity to price differentiation per channel and the trustworthiness in the service (as a perceived risk variable).

The dimensions mentioned focused only the IB service so future research should also examine other self-service technologies. The type of transactions performed per channel was not addressed in this study, however it would be interesting to analyze the channel preference due to the possible complexity of the transactions made.

Acknowledgements

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Co-Leadership and Hotel Management. The Account Systems USALI and BSC to Improve Effectiveness and Efficiency. The Portuguese Case

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Abstract – **In a very competitive, uncertain and very complex environment, it is supposed that changing from a single leader to a leadership team with complementary skills is an evolution that may highly contribute to motivate and to allow a good organizational environment, as well as to get a more effective and efficient system in the organization. This research aims to verify whether or not there is a relationship between the model of co-leadership and the improvement of effectiveness and efficiency in the Portuguese hotel companies. For this purpose, we got answers to 1723 questionnaires, interviews were made, customers' satisfaction was tested, economic and financial performance was studied and specific case studies were made. In the study, the results confirm that the stronger the co-leadership is, the better the effectiveness and the efficiency are. "Co-leadership" and "GOP – Gross Operating Profit" variables are strongly correlated among themselves and with other important indicators of operational effectiveness such as "Organizational Environment", "Work Motivation" and "Customers' Satisfaction".**

Keywords: Leadership, co-leadership, effectiveness, efficiency, hotel management.

1. Introduction

What is the secret of the competitiveness? Why do some companies thrive and others do not? Why some of them are highly profitable and others are not? Why some companies are highly creative and others just observe and follow?

In the observable reality, some organizations accept the *status* **quo**, the current competitive advantages they have. Others control the situation and create new competitive advantages. In essence, it is a matter of leadership and strategy (Barney, 1986, 1991; Hamel and

Prahalad, 1996, 1989, 1990, 1994a, 1994b)[1].

A study by the University of Warwick (Bennet, 2002), about the quality of management of Portuguese entrepreneurs and leaders, has concluded that a large proportion of them have a poor knowledge of management and culture. The Portuguese leaders do not plan or generate their activities considering objectives; they do not value properly their teamwork, they do not have a customer focus, they have a distant and autocratic leadership. Also the OECD report (2004) confirms these weaknesses regarding the Portuguese entrepreneurs and leaders. And, in fact, this occurs in many Portuguese hotel organizations where the family business and traditional individual "leadership" predominates.

Nowadays world is different and continues to change so fast that we get outdated and obsolete if we do not challenge our own beliefs and our paradigms.

Some years ago, a good hotel "general manager" in Portugal was considered the one who got experience in hotel management, and his essential role should be to get many clients for the hotel and to provide a good service to the client. Management techniques and team leadership were not taken in great consideration. This paradigm still persists in Portugal in this sector. Anyway, this is a transitional, heterogeneous phase, a mixture of persistent managing models and "new wave" directors, who try hard to fight against installed obsolete administrations. In the above referred cases the "leadership" is closely associated with the owner himself (founder or successor), as a result of a kind of

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[1]These authors are the main references of the "school of the resources" (resources based view) and have a strategic vision that puts the emphasis on the companies' own resources (core competences), that are intangible. Socially complex resources and organizational processes are seen as involving the true sustainable competitive advantage factors (resources, knowledge and strategic leadership). The pioneers of this theory were Chamberlin (1933), Penrose (1959) and, more recently, Sustained (1984) and Barney (1986, 1991). Anyway, the biggest references are in fact Hamel and Prahalad (1994).

dynasty based on the acceptance of a kind of "natural leader", whose "right" to "govern the House" passed from generation to generation. Even today, in many of the Portuguese independent hotel units, the hotel owner recruits a salaried director (usually a legal requirement), but always keeping the "rein in his strong hand", that is, there is a great control and a great interference to the point of not knowing exactly who is, in fact, the director in charge. This hotel management model may not have an easy differentiation from the traditional one. The hotel manager is, in fact, no longer "responsible" for a proper provision of the client services and, eventually, for hotel marketing. He is, essentially, a hotel operation technician, not a manager or a leader.

Thus, the future of many hotel companies is still very much viewed as a linear extrapolation of the past, what is incompatible with the new times and therefore with low effectiveness and efficiency.

In contrast to this, today's consumers are more demanding and "want more for less" and are not willing to pay for the inefficiencies. The competition is global and it is reached by the best companies. So it is crucial to have steady progress in products and services but at the same time in the processes, in leadership and strategic management philosophy.

2. The Problem

In Portugal, particularly in hotels, the average productivity is considerably low. So, in truth, "Portugal is not competitive". As a consequence "Portugal must approach the European partners' productivity levels"! This consists, firstly, on the need of getting to the top, to get the strategic development. So, the main problem is the growing imbalance between the social and business reality and the perceived situation of many Portuguese companies particularly in the hotel area and the position assumed by their administrations and directions. Therefore, one of the causes of the low productivity is in fact the outdated model of leadership and management referred above.

In many areas of human resources management, teamwork has several advantages compared to an individual work, although there are exceptions. In more complex functions (as it is the case of the hotel) and in a complex environment, uncertainty and ambiguity (as in the current situation), it may be more advantageous to bet on team work. For this purpose it is necessary to give more importance to a leadership with complementary skills. However, it is not easy to find all the important skills in a single leader. In fact, it is not easy for most hotel companies, to hire top leaders with complementary skills. Anyway, it seems that one of the

assumptions that can lead to a change of the above scenario may be the replacement of the traditional management model based on one person, by implementing a new team leadership model (co-leadership) with complementary skills that form and add leverage and may be found not only in the senior management, but on the whole team, from the top to the base. All this may be reached if it is supported by information systems and quantitative and qualitative measurement that are benchmarks such as the Uniform System of Accounts for the Lodging Industry (USALI) and the Balance Scorecard (BSC).

3. Literature Revision

A lot of literature has been written about leadership. But in the co-leadership area, information is scarce and relatively recent. Some organizational theories can be seen as a background to this theme. It is the case of total quality management, reengineering, benchmarking, empowerment, balanced scorecard, for example. Naturally, this issue also results from several theories on the area of leadership. It is the case of universal personality traits (years 1920), behavior styles (1940's to 1960's), situational and group theories (1960's to 1980's), function and group exercise and charismatic/transformational theories (1990's and following).

Although it is recognized that there are some inborn leaders, currently the idea that they are so few and so rare still predominates and as a consequence it is not possible to depend on them to guarantee the company's success. Consequently it is an evidence that leadership can and must be learned (see, for example, Drucker, 2006 [2004], 2009 [1989], 1999 [1990]).There will be some intrinsic features that are inborn. They can help but the real leadership can be found in ordinary people. However, it involves big changes and a huge personal dedication which most people do not want to undertake. Other people, in turn, do not even have the opportunity to practice it (Welch, 2005, 2005 [2001], Ghosn and Riès, 2003). The great entrepreneurial leader J. Welch says that there is no easy way to be a leader and, even so, there are good leaders – with all kinds of 'packaging'" (see Welch, 2005).

In spite of not being a novelty at all, co-leadership may be a good solution to tackle today's complex challenges particularly in the hotel management.

3.1 Co-leadership

3.1.1   Co-leadership: success and constraints

Considering that the Portuguese culture is of Latin origin it is characterized by a very strong chief, the

Patriarch, the "leader" who centralizes more or less everything and who is expected to solve all the problems. Leadership is obviously and clearly a natural gift and an individual activity. Usually it is assumed that leadership results from a singular person inheritance; a leader is considered just as a singular individual with single capacities.

However, the studies show that even the most famous leaders "loners" were surrounded by a team of other real leaders – see for example O'Toole (1999, 2001, 2002) and Heenan and Bennis (1999, 2001). These authors were the first to arouse attention to this new way of seeing and thinking about leadership.

The co–leadership is a key word which shows the way how power and decision are spread throughout the company. All societies had and have super stars, well-known leaders. However, there are many others who are not so well known. These authors' researches permit to conclude that the leadership identification with a single leader is a fallacy (and it is not simple to change the paradigm). The authors of these studies indicate that organizations major sustained success cases had a team at the top and not a single leader. Nowadays, living in a much more complex world, companies need talented teams, formed by leaders and co-leaders to work jointly as a team, in order to make things progress. According to these authors, it is possible to achieve through partnership what cannot be achieved individually. The visionary leaders of the future are the ones who recognize the importance of creating alliances with others, who are involved in common projects. These "heroes" can be completely different from each other. However, providing that they share an essential cooperation and collaboration results will appear. Behind a successful organization, there is a chart of co-leaders, who are the key people who do the work, even without being crowned with glory.

This new vision and a "primus inter pares" relationship reflect a radical change in the organizational life of a new era in which we are living today. Nowadays, ideas are indispensable and they are well received, wherever they come from, at any level in the company.

Anyway, a shared direction is not itself a sufficient condition to guarantee the highest effectiveness and efficiency in the institution management. A team shared direction may not result. There are necessary conditions to be successful.

So why are some executives really good on the power-sharing and some others fail? All these authors refer a number of factors, starting from the importance of the attitude of the ones who have the power and going to a series of requirements to be taken into account such as:

- the existence of a mutual understanding,
- having humility and confidence,
- ability to make a good team,
- having a real feeling about the advantage of having other powerful talents in the team,
- considering the strengths and contributions of other team elements,
- having chemistry among partners,
- sharing the limelight, in a positive way,
- delegating responsibilities,
- having a coordinated team work,
- etc.
  (see Heenan and Bennis, 1999: 231-280; O'Toole *et al.*, 2002: 15-20).

In short, the most important thing is to put the effectiveness of a joint project ahead of the ego. A visible advantage for the success of a co-leadership team results from facing the situations through a single vision and showing unity in good and bad times. The team members have to be honest with each other on the contribution each one gives the team and in the way they share the need for knowledge and power.

3.1.2 Co-leadership and an enlarged management structure

Pinchot and Pinchot (1993) say that the effective organization is the one which uses the intelligence of all its human resources (and not just the one of the superiors). Invited by the Foundation Peter Drucker (in 1996), to comment on what leadership will be like in the 21st century, Pinchot states that the organizations of the future will consist of intra-entrepreneurial (entrepreneurs) communities, i.e., small business owners who create businesses within the company. Therefore, the leadership methodology must be indirect, allowing the existence of a greater number of leaders within the organization. Soon, adds this author, delegation is not enough. The very concept of empowerment is not enough to overcome the traditional corporate bureaucracy. The only proper tool is the introduction of a market inside the company and the creation of an intra-entrepreneurs system. Peter Senge - another guest - defends the opinion that the challenges of systemic change cannot be solved by the hierarchy, not even by heroic leaders individually. A mix of different types of people is required, in different positions, which lead in different ways. Another guest of that event, Schein, referred that many more people within the organizations will have to play the leading role, to improve management. Kouzes and Posner, also guests, defend in their turn that leadership is an issue for

everyone. The most pernicious myth is the one that associates leadership to a role reserved only for a few. And they complete their arguments by saying that leadership is not a position, it is a process. Finally Blanchard, also a participant in the same event, said that even though the vision has to start from the top, each one must contribute to the process.

Thus, organizations which want to have all employees engaged in the implementation of their strategic project practice co-leadership. It has to be done not only at the level of top management, but, throughout the hierarchy, from the top to the base. The studied examples indicate that. Enough identification and combination of the factors enable this combination of directors to be successful. In this new organizational universe, the power and responsibility are not only distributed *inter pares* (no longer number 1 and number 2), but they are spread within the organization, and this allows the company to have a constellation of co-stars. Of course, this implies a very cohesive team, who share values and aspirations, aiming to work all together in one direction and common objective.

According to the summary of the literature presented, any ordinary person can be a co-leader as long as he wants to be, since he has the enough and adequate talent providing that the organization recognizes and values the co-leadership properly.

Heenan and Bennis (1999) say that the traditional structure of number 1 and number 2 (CEO and COO) is evolving and it will tend to something more fluid. Under the title "two people know more than a single one – sometimes", these authors show that, in order to create a strong top, some companies do purposefully choose a more radical co-leadership type of co-equals (perhaps more risky). And they present cases for this model "two for one". Then, Heenan and Bennis wonder if this unusual model will go ahead. Will they be able to sublimate their egos and continue to manage as co-equals? And they answer these questions by saying: "it depends on chemistry and respect" (...) "This requires exceptional people". Nevertheless, these authors refer various successful cases of co-CEOs, in which, for example, one focuses more on the vision of the company and the other one more on the achievement of the strategy. Yet they present external testimonies from people who applaud this challenging unusual co-leadership model.

But there are also those who are very skeptical about this model. Heenan and Bennis (1999) say that, in fact, the challenges of forming a strong team personality, in an *inter pares* co-leadership model, are

considerable. In this case, inevitable conflicts will occur. In co-leadership management (with number 1 and number 2), "the egos of each person" must always be taken into account, and even more on *inter pares* co-leadership. If the most essential conditioning factors are taken into account and are respected, the advantages of the model seem to be large and obvious. However, it is necessary to be very aware that the success of the co-leadership cultures depends on the mental attitude and commitment of the agents involved. The co-leadership keystone is the real will to share the power with the potential allies who should share the same convictions and who will complement each other. When everything fits, there are complementarities, affection, trust, values and commitment on the same joint project. The functions are easily distributed, according to the abilities of each member. The differences are resolved, at the right time, without acrimony and without loss of mutual respect. A great partnership benefits everybody.

In short, co-leadership is part of a strategy which releases all the talents of the entire organization. More than rhetoric about teamwork, co-leadership is a shared commitment. It is not only resumed to number 1 and number 2, but enlarged to the equals at all levels throughout the organization, to enrich and to facilitate the constant changes that are necessary to be introduced in the organization. The new leader is a co-leader who overpowers the hierarchy, who communicates freely with all the people at any hierarchical level, the one who prefers that his subordinates think by themselves as it is the case of the knowledge era's workers.

3.2 USALI (Uniform System of Accounts for the Lodging Industry) and BSC (Balanced Scorecard)

3.2.1 USALI and BSC: General Notes

Nowadays, USALI-Uniform System of Accounts for the Lodging Industry and the BSC-Balanced Scorecard are two important instruments in the analysis of leadership and in the strategic management for the innovative and competitive lodging industry. These two instruments are complementary as management information systems.

USALI is a uniform hotel management accounting system, specific to the lodging industry, which allows their members "to speak and understand" the same language in the co-leadership and management team. It permits to get standard indicators and, thereafter, any hotel can use it to compare average indicators of competition and, in addition, it permits to assign responsibilities to the directors (HANYC, 2006; Lamelas, 2004, 1982).

BSC is a measurement system of performances that previously considers a model of strategic management and then a system of measurement of the performance of that system. Finally, it can and must be associated with an evaluation system of the performances – see Kaplan and Norton (1996), Cruz (2005) and Bancaleiro (2006).

These two management tools use a technical language that can and must be used as a common bond among all team members, no matter if co-leadership team is more or less heterogeneous. It must happen in a very special way in the top co-leadership. If people have a common vocabulary and share a vision, and additionally share a set of objectives and a common perspective of what to do and how to do it, consequently they can coordinate their behaviors in a team, as much as they will work on co-leadership and more autonomously (Pfeffer, 1981, 1994 [1992]).

3.2.2 USALI and BSC contribution to co-leadership management

The organizations that aim to have all the employees engaged in the implementation of their strategic project use a co-leadership approach, which is leveraged by USALI and BSC methodologies. This happens not just at the level of top management, but going through the hierarchy, from the top to the base, as already referred.

The BSC permits this kind of alignment from the top to the base. It not only "obliges" companies to have a vision, a mission and a well-defined strategy, but it also provides a set of ideas and a specific language to communicate that vision, mission and strategy of the company. It reflects the existence of a mission and a strategy revealed throughout coherent objectives and measures that are organized considering four key areas: the financial, the customer's area, the internal processes, learning and growth. It provides the executives and the entire organization with a better understanding of the vision and strategy. It also provides an analysis of the effectiveness and efficiency of the action of all the agents involved, through an integrated and consistent set of performance measures. Since this approaching system has to be developed by the group of top executives, as a team project to which all contribute, it enables the top directors, each one with his own specialty, to make the team and create a consensus on areas of relative ignorance of each one individually. So the scorecard becomes a convergent path for top management team, as a way to build the organizational structure based on teamwork. Being the cornerstone of a strategic management system, it enables the alignment

from the top to the base. In fact, such a development necessarily begins on the strategic top team, by building a team which must be committed to undertake the project implementation. However, to achieve the maximum benefit, the top management team must share their vision and strategy with the organization as a whole and with important partners from outside the company. All the multiple BSC measures suggest the need of achieving the overall objective, which is the implementation of the integrated strategy, involving a "unity of purposes". Apart from contributing to maintain the financial gauges as critical lines for the organization performance, it draws the attention to a set of more general and integrated sensors that connect the customer's perspective, internal processes, employees and the performance system, which altogether bring long-term financial success. The use of this language and measuring tools as a means for understanding the organization performance also contributes to better understand some complex and often imprecise concepts in a clearer way which reinforces a consensus among the top managers. It also creates a shared understanding and a commitment among all organization participants by communicating the strategy and linking it to the personal objectives of each involved agent.

Indeed, all the multiple measures point to achieve the overall objective, which is the implementation of the integrated strategy, containing within it a unity of purposes. By communicating the strategy and linking it to the personal objectives, the scorecard creates a shared understanding and a commitment among all the participants of the organization. The alignment of the organization through the strategy should be encouraged by a system of rewards and incentives. This strengthens the role of the scorecard system as a cultural change factor.

In short, BSC contrasts with the lack of a systematic process to implement and obtain feedback on the strategy. It contrasts with the simple use of USALI which only provides economic and financial information, but it also relies on it for this purpose. As a consequence both of these methodologies appear as being complementary.

4. Methodology

The analysis of the literature shows that there are success cases of co-leadership throughout the organizations history. It also shows that a shared leadership is probably more efficient at solving the problem of low labor productivity in Portugal than the traditional model of central direction on a single director

or leader, in which he is the only one who has got the "know-how" and the decision power.

So, following the study of the hotel organizations operating in Portugal, the main aim was to verify what kind of leadership models would provide better results in terms of effectiveness and efficiency, i.e. the most centralized or the most participated ones, basing on the advantages of the complementary skills of co-leadership.

This research took place between 2005 and 2008. One questionnaire was used to measure the organizational environment (adapted from Quim, by the author) another one to measure the type of leader (adapted from Pitcher also by the author) and another one to measure the motivation (whose author is Hertzberg). The referred adaptations were based on the Portuguese reality. Furthermore interviews were made and reports of historical cases were analyzed.

So, in addition to a query made to hotel directors on a national scale, the main sample results from hotel groups operating in Portugal and from a set of 12 independent hotels, a set of 30 hotel groups were contacted and a valid collaboration of 14 was got. The number of valid inquiries for the analysis of context was 70; for the environment analysis, motivation (employees) and type of leadership (directors) 1653 were got; summing a total of 1723 inquiries. Additionally to these surveys, interviews were made to CEOs or equivalent and qualitative and quantitative performance measures were collected. Almost all these aspects are considered to be a sensitive matter for companies either they are qualitative (companies environment, motivation, leadership style, quality of service) or quantitative (several accounting performance indicators, for example). And this was, perhaps, one of the main restrictions to the survey. One has to say that this research began in 2005 and continued until 2008.

In addition to the methodological tools of research that were presented and in order to understand the dynamics of change in the organizations and co-leadership problem, the historical report of a changing experience of this kind of co-leadership in a specific hotel was used. The interest in this kind of organizational description, although it is relatively new in the field of management, it has been growing considerably. Its main objective is to try to understand the vicissitudes of a co-leadership model when successive attempts of carrying out a process of organizational change and development are implemented. Additionally it reveals a efficiency obtained in the results, contrasting with the apparent failure of each attempt itself. In this case, the efficiency was measured, based not only on the analysis of the evolution (internal and the market one), but also on statistics data (room occupation and average room rate, RevPar). Apart from that financial data (GOP and productivity) as well as the satisfaction evaluation of customer services (daily questionnaires) were considered. A good story can reverse a situation apparently failed into an unexpected triumph in the future (medium/long term).

5. Main Results

At this stage, it is convenient to consider that the objectives of this research are:

- First, to have a general overview of the predominant management model in enterprises and hotel units in Portugal. More specifically, to check out if there are hotel companies in Portugal implementing co-leadership theories or co-leadership practices.
- Second, to check out whether there is a significant and positive correlation between this leadership model (independent variable) and the effectiveness and efficiency (dependent variables).

As secondary objectives, it is important to ensure the analysis of the importance that is given to USALI and BSC tools such as the philosophy and a common language and the instruments for measurement of effectiveness and efficiency.

So, let us assume the general hypothesis that in the lodging industry, the key competencies such as strategic vision, operational performance and monitoring correspond to the key areas of management and hotel management today. Besides, let us also assume that these skills are distinct, identifiable and globally compatible and complementary. So, it is possible to define the specific hypothesis that the model of management and team management (co-leadership) offers significant advantages in terms of effectiveness and efficiency compared to the model of one-man management. This presupposes that the dyads or triads have been formed and mutually recognized and accepted as skills that complement and hopefully promote each other.

5.1 Analysis of the investigation results in a lodging industry context

Respondents to the survey of hotel context (made at national scale) indicate that most of the hotels are small (45.7% have not as many as 100 rooms and 65.7% fewer than 150). And approximately 55% are familiar or at least independent.

Most top administrations and directions from Portuguese hotel companies have centralized administration/ Directorate (31.7% of cases centralize everything and 17.1% only "delegate" the operations' area). However, according to the respondents, 25.7% of cases already practice a shared leadership (co-leadership type).

At hotel level, a centralized direction model also prevails, centralized in the person of the general director(GD) (in 36.4% the GD centralizes everything and in 24.2% centralizes everything except the financial function, which represents 60.6%). Only in 12.1% of the cases the three main competences work as a team (co-leadership).

On the use of hotel management accounting system, 59.2% of those who spoke out say they use it; 82.4% say it was adapted from USALI; 85.7% say that it permits to make interesting comparisons and 92.7% say it is "very" or "absolutely" useful to management. Therefore one can say that the hotel management accounting system used in the Portuguese lodging industry is virtually synonymous of the USALI model, also known as uniform system.

There is a very close relationship between the model used in hotel management and the use of USALI.

USALI is less used (only 11.9%) in hotel organizations with one administration that centralizes everything. The most decentralized organizations (which have a commercial, direction, an operation direction, an administrative and financial direction, separately from the Administration itself, i.e. closer to the model of co-leadership, representing 25.7% of the cases) use prominently the USALI (40.5%).

As already mentioned, most hotel respondents are independent and are the ones that less uses the USALI. On the contrary, the companies of hotel groups are the ones that most use this management tool. The use of USALI also varies not only with the category, but also with the size of the hotel unit. There is a direct relationship between the dimension and the use of USALI. The smaller the size and category of hotels, the smaller it uses.

Therefore the use of this important management instrument, the USALI, is directly associated with the dimension (of the hotel unit and the company), the category, the group and the co-leadership. On the other hand the BSC (also especially asked in the interviews) is almost ignored. Only in the largest companies did the interviewees say they were preparing its application. Since the BSC is a recent theory (is about 15 years old,

while the USALI is 85 years old)this is understandable. Even in universities did it only recently begin to be.

5.2 Analysis of the results of the relations between the co-leadership and other variables of effectiveness and efficiency

The analysis of the relationship between co-leadership and the other variables of effectiveness and efficiency regarding the present research, (Pearson r) shows results that corroborate the hypothesis of this research. It confirms that the management model and the management team (co-leadership) offer significant advantages in terms of effectiveness and efficiency, as compared to the model of leadership and unipersonal management.

In fact this research confirmed the existence of a strong and positive correlation between the variables "co-leadership" and "GOP" (Gross Operating Profit, i.e. the operational results) (r = 0.75). This means that the stronger the co-leadership pattern is in the Portuguese hotel business, the greater the profitability reflected in the GOP indicator is, that is to say, the operating results are much better.

In addition to this strong correlation among the variables "co-leadership" and "GOP", both of the mare positively correlated with the "organizational environment". This means that co-leadership tends to produce positive effects both in the operational results and in the labor environment, and this, in turn, tends to favor the operating results.

Let us assume, on the one hand, the correlations among three variables which are directly related to the human resources management:

- the strong correlation between "environment" and "motivation" (r = 0.85),
- the medium-intensity correlation between "environment" and "co-leadership" (0.54) and
- the weakest correlation between "motivation" and "co-leadership" (r = 0.29);

and, on the other hand, also

- the strong correlation between "co-leadership" and "GOP" (r = 0.75).

It is now possible to conclude that, in the Portuguese hotel business, a culture which focuses on the sharing of responsibilities and decision-making:

- is more effective (generating the biggest direct benefits in client satisfaction and ensuring the best psychosocial benefits, reflected into a better organizational environment and a greater labor motivation index);

- is also more efficient, once it ensures the best operating results.

Therefore, in the Portuguese lodging industry, the higher the penchant of co-leadership is, the better the organizational environment and the motivation in the company are, improving operational results and allowing a greater client satisfaction.

Basing on these data, one can say that the Portuguese lodging industry staff evaluates more positively the management performance and the leadership in hotels where there is co-leadership. Conversely, the evaluation is worse in these two dimensions of the organizational environment in the hotels in which decisions depend on a single person or are more centralized.

"The management performance" and the "leadership" are more favorably perceived by hotel employees where decisions are more decentralized and shared. It is natural that the organizational environment is also more favorable in these hotels. Two reasons contribute for that:

- on the one hand, the perception on the management performance and leadership are two of the constitutive dimensions of the global organizational environment;
- on the other hand, these dimensions are strongly and positively correlated with all the other dimensions of the organizational environment.

The hotels which adopt models of co-leadership find their efforts rewarded by getting better general performance ratios and not only rewards of a financial nature.

In the hotels dominated by co-leadership, there are:

- effectiveness gains (resulting from labor motivation, better organizational environment, significant improvement of perceived quality of services), and
- clear efficiency gains (at the operational profitability level).

5.3 Analysis of the experience of changes resulted from co-leadership at the studied hotel

A specific Portuguese Hotel was studied (Hotel A)[2]. After several attempts, finally in 2007 the minimal conditions and the necessary consensus for the implementation of policies and a strategic plan in this hotel were achieved. This plan has been integrated and participated transversely in the hotel. That is, after

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[2]Hotel name is not revealed by confidentiality reasons.

several attempts in previous years, the first formal experience of co-leadership was made possible. The architecture of this strategic plan (SP) and its implementation has been leveraged and coordinated by a minority owner who, at that time, had tacit power and the "know-how" to do that.

Despite the little enthusiasm and the progressive difficulties created by the strategic top peers, the truth is that this strategic plan - associated with the co-leadership model - was developed and worked throughout the year of 2007 and, by inertia, throughout a great part of 2008.

Except for the years in which Portugal had mega events (1998 and 2004), the years of 2007 and 2008 were the best in the history of this hotel, in terms of effectiveness and efficiency. Precisely in the years in which, for the first time, an integrated strategic plan was implemented, being supported by various manuals, participated by all the staff and set in motion by the model of co-leadership finally institutionalized. Never had this happened before in this hotel. Besides, such a plan was not usual in the lodging industry in Portugal.

The analysis of the indicators of effectiveness and efficiency of the experience of change, which was introduced by the co-leadership in Hotel A, shows the following:

- The occupancy rate rose from 63% in 2005 and 2006, to 68% in 2007 and to 72% in 2008. This was higher than the average competition not only in the geographical area (which was only 65% in 2007 and 63% in 2008) but it also exceeded the objectives set for this period in the SP (which was 63% for 2007 and 65% for 2008). In 2009 it fell -6.2%, compared to -5.9% in the Hotel A geographical area. So the reduction was higher than in the competition.
- The average room rate (ERR) fell first and rose slightly (from 45.0 in 2006, to 42.8 in 2007 and to 46.8 in 2008). At this point the SP objectives were not achieved and the hotel kept its prices still below the ones of the competition hotels. In 2009, the average price dropped -6.5%, against -6.4% in the zone. Therefore a dropping slightly higher than the competition.
- However, despite marketing costs diminished in 2007 and 2008, the evolution of the hotel sales in these years was very good and exceeded the objectives of the SP, being the variation of + 13.5% in 2007 and + 11.5% in 2008. It must be noted that, at the national level, hotel revenues rose only 11.7% in 2007 and 1.7% in 2008. Therefore the

selling price rise was lower than the hotel objectives, but it did not impact negatively on the sales amount, quite the opposite. In 2009 sales at Hotel A decreased 9%.

- So, RevPAR*(revenue per available room)*rose from 24.01€in 2006to 29.12€in 2007 (+ 21.3%) and to 34.14€(+ 17.2%) in 2008. Despite these significant increases, these figures were still worse compared with the ones of the competition, in which evolution was32.9 € (2006), 39.55 € (2007) and 37.25 € (2008). In 2009 this average dropped 12.1%, against a fall of 11.9% in the zone. So the reduction was higher than in the competition.

- The evolution of the total operating costs exceeded the SP objectives (a variation of +6%, in 2007 and in 2008, when the objectives outlined in the SP were, respectively, -6% and +2%). No data of this kind was available for competition.

- The GOP ratio (profitability of sales) did not reach the audacious objectives proposed in the SP (due to the costs increasing). However (and more important than that)it was far superior to the ones of2006 and 2005, respectively 26.5% and 28%, and rose to 31.3% and 34.6%in 2007 and 2008, respectively, i.e. variations of + 34.1% and + 23.0%. In 2009 it came down again to 32.2%, a reduction of -15%. No data available for competition. But the best performance results got through this research referred to an earlier period (in which the case of co-leadership prevailed) dominating the ranking from 30 to 40%.

- The average GOP per available room also recorded a very positive change: + 44.41% from 2006 to 2007 and + 15.35% from 2007 to 2008. In 2009 it decreased -15.8%.

- The GVA (Gross Value Added) had a variation of + 36.0% in 2007 and + 21.9% in 2008.

- Labor productivity also increased in the two years of the strategic management experience on co-leadership. It rose from 2.57 in 2006 to 2.74 in 2007 (+ 6.6%) and to 2.94 in 2008 (+ 7.2%). In 2009 (a year of heavy cuts in costs), dropped to 2.91. But the index of client satisfaction fell a lot, especially in the months of peak season (July, August and September, 2009).

In the last months of 2007, the external consultant for customers made the survey analysis of external clients referring to the first nine months of 2007, in which there was a significant improvement of the client satisfaction index[3]. To the question: "If you return to the area where the hotel is located, will you use our hotel?

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[3]This consultancy would be interrupted in 2008.

The overwhelming majority (81.3%) answered "Yes". The client satisfaction index (CSI) reaches its maximum value in the room service (94.9%), surpassing even the valuation index assigned to the reception staff (94%). The relatively low score on CSI is mainly associated to the first four months of this semester and is improving in recent months. "It is therefore expected that this indicator improves significantly" – the report says.

Concerning the 3rd quarter evaluation, the same report states: "the restaurant staff satisfaction improved significantly during the period July/September (despite being the peak of the high season).The respective index of satisfaction increased from 49 to 63.2. The "restaurant services" also showed better results in the summer period: in six out of the nine evaluated items there are significant improvements of the satisfaction index.

It shall be noted that the Strategic Plan of change was discussed and implemented precisely during the first months of 2007.

Therefore in the years in which ran this model of co-leadership, Hotel A has had the largest performance ever got.

However, despite this short experimental period, everything could have been better. But, worse than that, the strategic management in this co-leadership project, which was monitored by a minority owner, had no conditions to continue. Analyzing the process some strategic failures occurred in the top management. Although the General Director, managers and other front line employees were fully involved and were completely committed to the project, that seems to be essential, but not enough. It is crucial to have power. The project leader had no power. As Zalesnik (1989), Heenan and Bannis (1999) say: "leadership inevitably requires the use of power to influence the thoughts and actions of other people. Besides, it is shocking to see how often those who hold the power are tempted to make mistakes, sharpening their knives against a very useful potential ally. In the economy of the 21st century, the autocratic leader has little or no space. Leaders who will become successful, healthy and strong are those who are actually able to work together – they complete".

6. Conclusions

Low dimension hotel units prevail in the Portuguese lodging industry as well as the relatively small hotel groups.

Most directors of the Portuguese hotels are men and have a higher education.

There is a considerable percentage of hotel units using the analytical accounting management, being the USALI the best known system and the preferred one.

The centralized administrations prevail in the Portuguese hotel organizations and they are the ones who less use the USALI system. On the other hand, the most decentralized Portuguese hotel organizations occupy the second place, representing 25.7% and they are precisely the ones which most use the USALI (40.5%). The use of USALI also varies with the category of the hotels and with their size. The higher the category and the size are, the higher USALI utilization is, and vice versa. The family hotels and the independent ones are the hotels that less use USALI and the grouped hotels are the ones which use it more.

As stated before, in the Portuguese hotel organizations there is an administration which centralizes everything. The more independent the hotels are, the more centralized the top management is and vice versa. The larger the size of the hotel unit is, the greater the decentralization is and vice versa. The bigger the hotel group is, the bigger the tendency seems to be for a co-leadership. It is also in the hotel companies, in which a centralized administration prevails, that a centralized direction can be registered in the hotel units.

So it is possible to conclude that these survey results confirm the perceptions and the above analysis of the situation about this theme.

In turn, the leadership top team varies with the size (the larger the dimension, the greater the decentralization and vice versa). It also varies with the independence (the more familiar or independent the hotels are, the more centralized the top management is and vice versa). Furthermore it varies with the size of the hotel group (the larger the hotel group is, the bigger the tendency is, for a co-leadership).

As expected, there is a strong correlation between the management registered at the top level of the hotel companies and at the level of the hotel units. The hotel companies, where the Administration is predominantly centralized, register a centralized direction which can also be registered in the hotel units. This makes sense, as it is in the top that "rules are conceived" and it is the top that leads the way.

The education level of the GD does not seem to affect the decentralization as much as one might expect. This can perhaps ~~is~~ be justified by the fact that more than 75% of GD's already have higher education and their administrations remain very centralized. But it also makes us recall the Druker's criticism that "our universities still teach and practice the idea of one leader".

Regarding the analysis results of the changing experience in a co-leadership (years 2007 and 2008) listed in the reported case, it is possible to conclude that:

- Effectiveness and efficiency indicators show that the years of 2007 and 2008 were the best the hotel had ever got. This may probably also be a consequence of the favorable national and international tourism context. However, as the external environment of the year 2006 was also quite favorable, it provided a good year for the lodging industry. In spite of that there was a decrease in the activity and the performance of Hotel A, in spite of having spent the maximum amount on marketing. One can say that the Hotel was going against the cycle. Hence, it seems that we can infer that the very profitable years of 2007 and 2008 may have not depended just on the good general context.

- Other factors have contributed, especially the new strategic management model supported by co-leadership. In previous years, a strategic plan had never been assumed (and it was always a matter of discussion on the Board): a strategic plan framed in an assumed co-leadership. This happened for the first time at this Hotel, in 2007 and 2008. Therefore, in the years in which this model of co-leadership was implemented, this Hotel got the highest performance it had ever reached.

- In short this new study about the Portuguese lodging industry offers several relevant information, which can be considered at different levels, such as: information about hotel managers and to what point they use the USALI methods, information relating to the kind of direction that predominates in the companies (administrations) and their hotel units (where they are agents), the employment environment and the degree of employees' motivation in the hotel lodging industry. Even more important is the information about the relationship of all these matters with the essential objective: effectiveness and efficiency. Bearing in mind that the structural problems of low productivity of Portuguese companies is a requirement to solve, the analysis of the results of this survey reports that increasing productivity can result from the existence of a co-leadership.

Acknowledgements

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Some Imperative Issues and Challenges in Implementing Basel II for Developing Economies with Special Reference to Bangladesh

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Abstract - **In June 2006, Basel Committee on Banking Supervision issued a comprehensive document on New Capital Adequacy Framework to replace the 1988 Basel Accord and to foster a strong emphasis on risk management and to encourage ongoing improvements in banks' risk assessment capabilities. This paper attempts to explore some significant issues and challenges in Basel II implementation for the developing economies like Bangladesh. There are many possible negative impacts of an unchecked implementation of Basel II. The paper also tries to find out what Basel II norms should be applied - and to what extent - to ensure the survival and growth for the developing economies. The norms of Basel II intend to strengthen the banking systems globally and this objective should not be lost. Developing Economies - like Bangladesh Economy - need to be prepared and adapted according to the changing global conditions and according to the norms for matching the economies with the capabilities of developed ones. The impact of implementation of Basel II on the banks, the industry and the society should be carefully evaluated.**

Keywords: Basel I, Basel II, Capital Requirements, Developing Economies

1. Introduction

Capital is the fuel and financial information the necessary inputs which help to keep the engine of an economy in the right track. Banking is a business based on the confidence and trust of people enabling the mobilization of the funds from the surplus units to the deficit units thereby ensuring floatation of the company businesses. In this case, Basel Accords ensure this confidence and trust by providing some important guidelines to the banks with regard to fulfilling their minimum capital requirements, addressing risks properly, ensuring supervisory review, maintaining market discipline and so on.

In 1988 the 'Basel Committee on Banking Regulations and Supervisory Practices', for the first time, released a capital adequacy framework, now known as Basel I. This initiative was set out to maintain an internationally accepted framework for measuring capital adequacy and ensuring sustenance of necessary ratios in terms of the availability of assets of various types. This norm was widely adopted in over 100 countries including Bangladesh, which was implemented by 1990s. Over the years, the Basel I framework was found to have several limitations such as its simplified approach to credit risk, its narrow coverage being confined to only credit and market risks, and non-recognition to other credit risk elements. Moreover, the rapid advances in risk management, information technology, banking markets and products, and banks' internal processes, during the last decade, had already outpaced by far the simple approach of Basel I. Therefore, a need was felt for replacing this Accord with a more risk-sensitive framework, which could address these shortcomings better.

On June 26, 2004, the Basel Committee on Banking Supervision (BCBS) released in the second

round the document under the nomenclature 'International Convergence of Capital Measurement and Capital Standards: A Revised Framework', which was again supplemented in November 2005 by an updating with the Market Risk Amendment. This document, popularly known as "Basel II Framework", offers a new set of international standards for establishing minimum capital requirements for the banking organizations. It emphasizes on the modern risk management techniques and seeks to establish a more risk-responsive linkage between the banks' operations and their capital requirements. It also provides a strong incentive to banks for improving their risk management systems.

2. Scope and objectives

The paper focuses on the most important issues and challenges associated with Basel II implementation in the developing economies. The study has been conducted in accordance with the following objectives:

a) To identify the issues and challenges that banks face in implementing the Basel II in a developing country as it is the case of Bangladesh.

b) To examine the justification of adopting Basel II for the aligning domestic banking system with that of the global banking system.

c) To explore the extent to which the existing norms of the Basel II should be applied and adapted for the growth of developing economies.

3. Literature Review

Several strands of theoretical literature have emerged on the topic. A first strand uses the portfolio approach of Pyle (1971) and Hart and Jaffee (1974), where banks are treated as utility maximizing units. In a mean-variance analysis that allows banks' portfolio choice to be compared with and without a capital regulation, Koehn and Santomero (1980) showed that the introduction of higher leverage ratios will lead banks to shift their portfolio to riskier assets. As a solution to such a situation, Kim and Santomero (1988) suggested that this problem can be overcome if the regulators use correct measures of risk in the computation of the solvency ratio. Subsequently, Rochet (1992) extended the work of Koehn and Santomero and found that effectiveness of capital regulations depended on whether the banks were value-maximizing or utility-maximizing. In the former case, capital regulations could not prevent

risk-taking actions by banks. In the latter case, capital regulations could only be effective if the weights used in the computations of the ratio are equal to the systematic risk of the assets. A further theoretical ground argued that banks choose portfolios with maximal risk and minimum diversification.

The second strand of literature on the topic utilizes option models. Furlong and Keeley (1989) and Keeley (1990) developed several models under this framework and showed that higher capital requirements reduce the incentives for a value-maximizing bank to increase asset risk, which is opposite to the conclusions of the first generation studies discussed above. They criticized the utility maximizing framework, which comes to opposite conclusions, as inappropriate because it mischaracterizes the bank's investment opportunity set by omitting the option value of deposit insurance and the possibility of bank failure. However, this evidence of the option model was weakened by the findings of Gennote and Pyle (1991). They relaxed the assumption that banks invest in zero net present value assets and found that there are now plausible situations in which an increase in capital requirements results in an increase of asset risk.

Using a dynamic framework (multiple periods), as opposed to the static framework used in the studies above, Blum (1999) found that capital regulation may increase banks' riskiness due to an inter temporal effect. Using a two-period model, he showed that banks find it too costly to raise additional equity to meet new capital requirements tomorrow or are unable to do so, they will increase risk today. He also pointed out that this second effect will reinforce the well-known risk-shifting incentives due to the reduction in profits. Subsequently, Marshal and Prescott (2000) showed that capital requirements directly reduce the probability of default and portfolio risk and suggested that optimal bank capital regulations could be made by incorporating state-contingent penalties based on banks' performance. At the same time, Vlaar (2000) found that capital requirements acted as a burden for inefficient banks when assets of banks are assumed to be fixed. However, such regulations increased the profitability of efficient banks. In short, whether imposing harsher capital requirements leads banks to increase or decrease the risk structure of their asset portfolio is still a debated question and, at least for now, it seems, there is no simple answer to this question.

4. Causes for the Emergence of Basel II

Basel I (First Accord) adopted in 1988 suggesting norms for capital requirements and addressing credit risks has been outmoded owing to many reasons, which include, among others, simplified approach to credit risk measurement, narrower coverage being confined to only credit and market risks, non-recognition to other credit risk elements, the increased complicacy in risk management, advent of information technologies, intricacy in banking markets and product diversity, and the banks' internal processes themselves. Basel II (International Convergence of Capital Measurement and Capital Standards - A Revised Framework) is the updated version of the previous one and embodies some recommendations for revisions of the international standards for measuring capital adequacy. It was created to promote greater consistency in the way banks and banking regulators approach risk management across national borders with a primary focus on internationally active banks in order for enabling them to be responsive to more risk sensitive culture, which is expected to emerge throughout the world.

Basel II uses a 'three pillars' concept -- minimum capital requirements; supervisory review; and market discipline -- to promote greater stability in the financial system.

4.1 Pillar-1(Minimum Capital Requirement)

The first pillar contributes for the improved risk sensitivity measurement in the way that capital requirements are calculated based on all the three components of the risk that a bank faces such as credit risk, operational risk and market risk. In turn, each of these components can be calculated in two or three ways depending on degree of risk intensity. Other risks are also there, but cannot be fully quantified in some cases. The technical terms used to denote the most sophisticated measures for credit risk include EL (Expected Loss) which components are PD (Probability of Default), LGD (Loss Given Default), and EAD (Exposure at Default). Calculation of these components requires advanced data collection and developed risk management techniques.

The Basel I accord only dealt with parts of each of these pillars. For example, from the key pillar one, credit risk was dealt with in a simple manner and market risk was an afterthought. Operational risk was not dealt with at all in Basel I. An instance of not assessing operational risk has been the recent pilferage of valuables from safe lockers at a branch of commercial bank in Dhaka.

4.2 Pillar-2 (Supervisory Review)

The second pillar deals with the regulatory aspects relating to the first pillar, giving regulators much improved 'tools' over those available to them under Basel I. It also provides a framework for dealing with effectively all the other risks that a bank faces, such as risks associated with bank company reputation, liquidity, and legal, which are grouped together under the title of residual risk. 'Supervisory Review Process', is the element, which makes the revised framework very comprehensive attempts to address the entire risk domain of the banks. It requires the banks to develop an Internal Capital Adequacy Assessment Process (ICAAP), which should encompass their whole risk universe - by addressing all those risks which are either not fully captured or not at all captured under the other two Pillars, and assign an appropriate amount of capital, internally, for all such risks, commensurate with their risk profile and control environment. Under the Supervisory Review, the supervisors would conduct a detailed examination of the ICAAP (Internal Capital Adequacy Assessment Process) of the banks, and if warranted, could prescribe a higher capital requirement, over and above the minimum capital ratio envisaged in Pillar 1.

4.3 Pillar-3 (Market Discipline)

The Pillar-3 of the framework, Market Discipline, focuses on the effective public disclosures to be made by the banks, and is a critical complement to the other two Pillars. It recognizes the fact that apart from the regulators, the markets also monitor the banks and that the discipline exerted by the markets (information relating to market) can be as powerful as the sanctions imposed by the regulator. It is premised on the basic principle that the markets would be quite responsive to the disclosures made and the banks would be duly rewarded or penalized, in tune with the nature of disclosures, by the market forces which was absent in the Basel I.

5. Issues and Challenges Associated with Implementing Basel II in Bangladesh

The proposed implementation of the Basel II accord for Bangladesh banks with the objective of promoting stronger risk management practices presents a serious challenge in terms of managerial capabilities. The development of such capabilities in the local industry requires both intensive training as well as behavioral and attitudinal changes. Some of

the major issues and challenges that might arise in respect of Bangladeshi banking system because of the adoption of the Basel II framework are outlined below.

5.1 Pre-Implementation Considerations - Timing of Implementation

Although there is a widespread recognition that Basel II is more sophisticated than Basel I, there has been considerable debate with regard to the appropriate timing of Basel II even among developed countries. While most European Union (EU) countries have followed a '2007 parallel - 2008 live' timeline, the US regulators have deferred implementation to a '2008 parallel - 2009 live' timeline.

Premature adoption of Basel II in countries with limited capacity could inappropriately divert resources from the more urgent priorities, ultimately weakening rather than strengthening the supervision. The International Monetary Fund (IMF) agreed, in one of its publications, that countries should give priority first to strengthening their financial systems comprising institutions, markets and infrastructure and focus on achieving greater level of compliance with the Basel Core Principles.

With that view in mind, the Bangladesh Bank needs to decide whether the timeline that it is contemplating in this respect is an appropriate one for Basel II implementation. At a minimum, the following may be recommended for implementation before Bangladesh moves into Basel II:

1. Implementation of 'Market Risk Capital' as an addition to Basel I first;

2. Automation of regulatory return submission - developing IT infrastructure for the local banks;

3. Capacity building for Central bank; and

4. Developing robust External Credit Rating Agencies (ECAIs).

5.2 Selection of approaches

As Basel II offers a range of approaches, it is important to understand the difference between them for selecting the right approach so that their initial introduction in the Bangladesh market can be made possible better. Bangladesh Bank has already announced that it intends to implement simpler approaches of Basel II (i.e. Standardized for Credit Risk, Basic/Standardized for Operational Risk and Simplified approach for Market Risk), which is probably the right choice. However it is important to recognize the limitations of simpler approaches.

Standardized Credit Risk approach is heavily dependent on credit ratings from external rating agencies. Simpler approaches of operational and market risk does not effectively attempt to quantify the risk of the bank - they are more ballpark addition to the capital based on Bank's size of operation. Implementation of these simpler approaches can only generate the true benefit of Basel II if the quantitative capital assessment is coupled with qualitative measures of containing risk through better risk management practices. To ensure this, regulatory supervision needs to be strengthened. Wherever banks would be found deficient in their risk management practices, there is provision in Basel II for supervisors to call for an additional capital as a part of Pillar 2. This supervisory role needs to be executed prudently.

The advanced approaches have their limitations and involve wider range of issues as well, and they may be more problematic for Bangladesh. When most of the international banks with the state-of-the art banking practices are struggling to comply with the requirements of advanced approaches, and the supervisors even in developed countries are struggling with the task of reviewing and approving advanced models, the Bangladesh Bank has appropriately decided not to venture that route in the immediate future.

5.3 Implementation Consideration - The Industry -- External Credit Rating Agencies (ECAIs)

The Standardized Approach for credit risk leans heavily on the external credit ratings. While there are a few rating agencies operating in Bangladesh, the rating penetration in Bangladesh is rather low. It is doubtful without a solid base of ECAIs operating in country how effective the implementation will be.

There is also a consideration whether the ratings of International Credit Rating Agencies would be accepted in capital calculations. International ECAIs like Moody's, S&P, etc usually rate the head-office of the multinational corporations. Whether that rating would be acceptable for their Bangladesh subsidiaries is a point to ponder. Furthermore, there would always be a wide gap between the rating of an International agency and a local agency. In general, International agencies have much stricter rating practices, which, if accepted as a norm, would generally result in a capital requirement significantly higher than Basel I for the Bangladeshi banks. This creates an incentive

for some of the bank clients to remain unrated since such entities receive a lower risk weight of 100 per cent vis-à-vis 150 per cent risk weight for a lower rated client. This might specially be the case if the unrated client expects a poor rating.

5.4 Market Readiness

The disclosure requirements under the Pillar-3 of Basel II are quite extensive in nature. They are probably designed to suit to advanced markets where there are numerous analysts to analyze and understand the disclosures and take investment decisions based on that. It is doubtful whether the market of Bangladesh is at all ready to take benefit of such extensive disclosures. If not, then requiring banks to adhere to such disclosure requirements would overburden the banks without any practical benefit.

5.5 Banking *vs*. Non-Banking Financial Institutions (NBFIs)

Since only banking institutions are subject to Basel II requirements, banks may find themselves in competitive disadvantage against specialized financial institutions, especially, leasing companies, microfinance institutions, foreign exchange remittance facilitating institutions and mutual funds. More specifically, where banks provide services similar to these organizations, they may find it difficult to compete due to additional capital requirement which NBFIs would not have. This may create an asymmetry in the industry.

5.6 Implementation Consideration - For the Regulator

Considering resources adequacy, implementing even the simpler approaches of Basel II requires significant involvement of the regulators, to ensure that the banks are not misusing the new rules. Several activities may require considerable involvement of the central bank:

1. Issuing detailed Basel II Guidance, including all national discretions carefully evaluating their impact on the industry.

2. Evaluating and continuously monitoring approved ECAIs.

3. Educating banks.

4. Monitoring and taking decisions on Home-Host issues for international banks through continuous dialogue with supervisors in other countries.

5. Human Resource and IT Infrastructure to review and evaluate banks' capital calculations.

6. Supervising banks under Pillar- 2 of Basel II.

7. Deciding Pillar -3 disclosure requirements and monitoring practices.

Without adequate capacity building of the central bank to perform all these tasks in a timely fashion, Basel II Implementation would definitely be hampered.

5.7 Implementation Consideration - for the Banks

Possible higher capital requirement, under the new accord, might, in some cases, lead to an increase in the overall regulatory capital requirements for the banks, particularly under the simpler approaches if adopted in Bangladesh. If the additional capital required for the operational risk is not offset by the capital relief available for the credit risk. This would, of course, depend upon the risk profile of the banks' portfolios and also provide an incentive for better risk management. But the banks in such cases would need to be prepared to augment their capital through strategic capital planning.

5.8 Increased Competition for Better Rated Clients

The new framework could also intensify the competition for the best clients with high credit ratings, which attract lower capital charge. This could put pressure on the margins of the banks. The banks would, therefore, need to streamline and reorient their client acquisition and retention strategies.

5.9 Changes in Banking Practices

The use-test requirement of Basel II dictates that banks must use the capital calculations in their management decisions like selection of clients, pricing banking products etc. This would require changes in banking practices often resulting in over-dependence on the external ratings of the clients. The larger local banks including the nationalized banks may have a very difficult time in implementing changes.

5.10 Increased Competition in the Labor Market

Most countries implementing Basel II have experienced shortages of skilled people for their industries who can understand and implement the sophisticated Basel II requirements. Likewise, banks

in Bangladesh are also   likely to face similar constraints. A good number of trainings and development programs along with seminars and symposiums, etc can help overcome this problem.

5.11 Expensive Software

Software solutions for Basel II calculations available in the international market are quite expensive. While international banks can probably take advantage of software solutions procured by their head office, the local banks may find it burdensome financially in procuring and developing such software.

5.12 Competitive Disadvantage for Smaller Banks

Smaller banks with a concentration on higher risk client group may find it to their further competitive disadvantage in implementing Basel II as this may require them to maintain relatively higher capital level than the bigger banks do with less risky client base. While this is a strong incentive to improving bank's risk management practices, some of the smaller banks in the Bangladesh industry are already finding their operations challenging, and they may be further tailored as per Basel II requirements.

5.13 Implementation Consideration - For the Society

The possible increased capital requirement and the significant cost of implementation may ultimately result in higher cost of banking services for the society. This may be especially true for corporate clients with weaker risk profile. Since the capital requirement of such clients will be several times higher than that of a larger, less risky client, banks will be inclined to charge them a significantly higher price for loan-type products.

5.14 Unique Market Practices

Basel II accord may not be adequate to cover some special type of banking practices seen in Bangladesh. In Bangladesh market, banks are encouraged to provide credit to agrarian industries and agricultural farms as well as export oriented firms.

The regulators should be careful that these firms don't get at a disadvantageous position due to the new accord. If necessary, special "regulatory-segment" should be defined to allow preferential risk weights to these industries.

Another unique practice is Islamic Banking. While Basel Accord is silent about this important banking product, some regulators (e.g. the Malaysian Regulator-BNM) have already defined Basel II rules for Islamic Banking. The Bangladesh Bank can follow this precedence.

6. Conclusion

It is obviously important for any economy to keep attuned with the pace of development processes of the developed countries where banking sector can play an important role in the process. The contexts in which the developed economies have to set out the new accord of Basel II in their economies, a similar context must be considered for the economy of Bangladesh, what requires a certain development in order to reap up the full benefit from the implementation of Basel II. By the time the Basel I is being implemented, steps should be taken extensively to make Bangladesh people concerned familiar with Basel II, to develop the economy in a suitable way for its implementation. The slow implementation policy in respect of Basel II would give a leeway to Bangladesh industries concerned to grow further to accommodate the Accord. Especially it should be given a top priority to the development of local ECAIs (External Credit Rating Agencies) before abruptly adopting the Standardized approach of Credit Risk - which is fully dependent on external rating. At the time of the implementation of Basel Accord II, the impact on the banks, the industry and the society should be carefully evaluated. The financial policy makers should be more careful about Bangladesh economic standards and about the competency of the national financial institutions while implementing Basel Accord II. Developing economies like Bangladesh's one need to be prepared and to be adapted to the changing global conditions and to the norms of the Basel II for Bangladesh own advantage.

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Regional Income Differences in Borderlands: A Convergence Analysis

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Abstract - **We intend to answer questions like if geography influences the pattern of inequality, that is, if the standard of living varies from region to region, with special attention to the borders, and if it reveals the presence of spatial correlation. The aim of the paper is to study the regional income differences among the NUTs 3 regions of Portugal and Spain in the borderland of these two countries. After a brief introduction we evaluate the inequalities among borderland regions using information about per capita wages. Considering the neighbourhood relationships between the NUTs 3 regions located in the Portugal-Spain border it is possible to conclude that wages are spatially autocorrelated.**

Keywords - *Borders; borderlands; income distribution; spatial correlation; Spain; Portugal.*

1.   Introduction

Regional imbalances represent an intrinsic characteristic of the European economy. In fact, as stated in Mateus et al. (2000), the structural evolution of the European economy has shown a real convergence between countries and divergence between regions, so the economic and social cohesion, namely the approach of the various territories in terms of standard of living is assumed to a primary objective of economic policy. As such, concerns about inequality in income distribution have gained importance, encouraging the various studies that address specially inequality among individuals within each country [see the studies of Rodrigues (1994, 1999, 2008) for Portugal and, for instance, García & Molina (2001), Goerlich & Mas (2001) for Spain].

The aim of this paper is to study the regional income differences among the NUTs 3 regions of Portugal and Spain in the borderland of these two countries. Following Guerreiro (2012), our research aims to address the problem of inequality in income distribution from a different perspective and we want

to answer the following questions:

- Does geography influence the pattern of inequality, especially in borderland?

- Can we observe spatial correlation in regional per capita wages, especially in the borderland?

To meet the objectives set out, we evaluate the inequalities and spatial correlation among borderland regions using information about per capita wages.

After this introduction, in section 2 we present the methodological framework and the results about regional income differences in the Portugal-Spain border. Finally, we conclude with a synthesis of results and possible future developments in the context of this work.

2.   Regional income differences in the Portugal-Spain border

2.1 Methodology

Given the importance that spatial phenomena such as spillover effects, location and distance assume in regional science, it is clear that spatial dependence is a phenomenon that plays an important role in this science. Consequently, if the values observed by some variable do reflect some spatial dimension, as the result of some of those phenomena, which may be theoretically explained or simply data driven, the use of statistical techniques that take that dimension into consideration is obviously desirable (see Anselin 1988 as (one of) the first comprehensive textbooks on these matters and/or Arbia 2006 for a recent textbook contribution).

The application of spatial statistics techniques can thus be justifiable when it exists a theoretical model supporting the existence of spatial dependence, and/or the data shows evidence of spatial autocorrelation after being detected by suitable tests.

As such, the detection of spatial dependence is of obvious importance in these matters. The use of a neighbouring matrix makes it possible the computation of a statistic for the Moran's I test, which is, roughly speaking, the correlation coefficient between the values of the variables by each spatial unit and the mean values of that variable in neighbouring spatial units.

That computation, in turn, requires the determination a neighbouring matrix, which can be related with distance or just contiguity relationships. In this last case, two kinds of contiguity can be considered: (a) a 'rook' kind, which considers a spatial unit j to be a neighbour of spatial unit i when it shares a common border and (b) a 'queen' kind, which considers a spatial unit j to be a neighbour of spatial unit i when there is a, at least one, point that is common in the borders of both spatial unit. In each of the two cases, one may construct a neighbourhood matrix $W = [w_{ij}]$, where $w_{ij} = 0$ if spatial unit j is not a neighbour of spatial unit i (and if i = j) and $w_{ij} = 1$ if spatial unit j is a neighbour of spatial unit i.

As a matter of fact, the comparison of the values registered by the variable of interest, at location i, and the average of the values registered by its neighbours allows to conclude about the relative (to its neighbours) performance of each spatial unit, taking into account that spillover effects may exist and significantly contribute to that performance (Caleiro, 2007) . In the next section this methodology will be applied to the 2008 per-capita wages registered by the NUTs 3 located on the Portugal-Spain border.

2.2 Results

In the Portugal-Spain border there are 10 Portuguese NUTs 3 and 7 Spanish NUTs 3. Table 1 shows the list of these and the values of the 2008 per-capita wages.

Table 1- Per capita wages (2008) in the NUTs 3

Nuts 3	Per-capita wages (euros)
Minho-Lima	15852.18
Cávado	15866.00
Alto Trás-os-Montes	18090.04
Douro	16870.45
Beira Interior Norte	17430.45
Beira Interior Sul	18049.92
Alto Alentejo	18132.36
Alentejo Central	17935.46
Baixo Alentejo	18692.29

Algarve	17593.60
Pontevedra	27361.83
Orense	25406.25
Zamora	27099.62
Salamanca	27708.99
Cáceres	26408.33
Badajoz	25502.68
Huelva	26471.21

Table 1 shows the apparent difference on the standard of living between Portugal and Spain. Moreover, the disparity of wages is higher in Portuguese side of the border (standard-deviation of 967.99) than in the Spanish counterpart (standard deviation of 888.26). This fact indicates the existence of higher inequality in wage distribution in Portugal than in Spain.

Given our objectives, it is important to take into account also the NUTs 3 that, despite not being located in the border, are in the neighbourhood of those under scrutiny (see Figure 1). In what concerns Portugal, those include Ave, Grande Porto, Tâmega, Dão-Lafões, Cova da Beira, Serra da Estrela, Pinhal Interior Sul, Lezíria do Tejo, Médio Tejo, Alentejo Litoral and Península de Setúbal. Concerning Spain, those include La Coruña, Lugo, Léon, Valladolid, Ávila, Toledo, Ciudad Real, Sevilla, Córdoba and Cádiz.

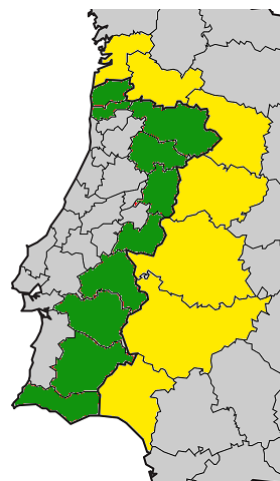Figure 1 – The NUTs 3

Considering now the neighbourhood relationships between the NUTs 3 located in the Portugal-Spain border it is possible to conclude that wages are spatially autocorrelated (correlation coefficient of 82,01% with all the neighbours) but that is due essentially to the domestic neighbours (correlation coefficient of 96,91% with all the domestic neighbours) and not at all with the

neighbours of the other country (correlation coefficient of -96,87% with all the foreign neighbours), such that a clear border effect – in the restricting way – do exist (correlation coefficient of -10,05% with all the neighbours in the border).

3. Conclusion

This paper is about regional income differences in borderlands. It considers the particular case of wages per capita on the NUTs 3 located in the Portugal-Spain border. Using a spatial econometrics approach, i.e. taking into account the neighbourhood relationships, it is concluded that wages are spatially autocorrelated, which, indeed, justifies that approach. Moreover, it is concluded that there is a clear border effect, as a barrier to wealth spreading.

Plainly, it is possible to better study the convergence patterns among the regions (under study) by considering an extended time horizon. This would make it possible to estimate spatial econometric models to test convergence. Moreover, there are apparent potentialities of spatial clusters as a complementary analysis in the study of regional income differences, whether in borderlands or not.

The current paper is to be continued through the use of complementary methodology and more extensive comparisons.

Acknowledgments

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INTEREST RATE RISK IMMUNIZATION - THE IMPACT OF CREDIT RISK IN THE QUALITY OF IMMUNIZATION

CASE STUDY: IMMUNIZATION WITH PORTUGUESE BONDS AND GERMAN BONDS

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Abstract – This paper contains an assessment of the interest rate risk present in Financial Institutions and the methods used for its immunization. The paper consists of two parts. The first part presents a theoretical review of the interest rate risk and how this risk can be immunized. Concepts such as Macaulay (1938) and Fisher & Weil (1971) duration and their limitations in the process of the approximation to the price of a considered bond will be highlighted. In the second part, the main indicators of the credit risk on bonds are analyzed. Based on market prices of Portugal's bonds and Germany's bonds, the quality of immunization is tested. The interest rate derivatives are then introduced as a method of hedging interest rate risk. Finally, an interview is conducted with the head of hedging the interest rate risk in one of the largest private banks in Portugal in order to identify the methods used to capture the interest rate risk and to understand how this risk is immunized. This research allows us to emphasize the importance of credit risk in an immunization strategy of interest rate risk. We conclude that interest rate hedging based on Fisher & Weil (1971) duration is not possible in a scenario of high volatility credit risk. Interest rate hedging based on interest rate swaps becomes more attractive to Financial Institutions.

Keywords - Duration, Interest Rate Risk, Immunization, Credit Risk.

1.   Introduction

In late 2009, the first signs of a sovereign debt crisis in the Euro Zone appeared. In 2010, Greece and Ireland were the first countries to ask for support from the International Monetary Fund, followed by Portugal's request in 2011.

The European sovereign debt crisis resulted from a combination of complex factors and financial globalization. A major reason was the ease of access to credit, from 1999 to 2007, which encouraged high-risk loans, and the global financial crisis, which began in 2007 and required a bailout of the financial sector.

Thus arose a crisis of confidence in financial markets, which led to the widening of bond spreads and credit default swaps between these countries and other members of the European Union, especially to Germany.

These financial indicators led to several downgrades in the banking sector and countries in the Euro Zone. Those downgrades were made by Standard & Poors and Moody's. Currently, Greece and Portugal are considered high risk investments (junk bonds). Given this, the yield to maturity of these countries reached values which were too high, making it unsustainable to get credit without the assistance of others.

With this high volatility in financial markets, it is essential to create an efficient hedge of various financial risks, including the interest rate risk and credit risk. Due to its importance, we will now define these two types of risk. The interest rate risk is the risk for a portfolio or business resulting from an adverse change in interest rates in the financial market. In turn, the credit risk is the risk of loss of principal or loss of a financial reward stemming from a borrower's failure to repay a loan or otherwise meet a contractual obligation.

Taking this into account, we can then consider interest rate risk immunization strategy as the strategy to ensure that, regardless of the evolution at the level of interest rates, the future value of an investment is at least equal to the value that would be obtained if interest rates did not change.

On this basis, several concepts have been developed over time. In interest rate risk immunization described by Bierwag (1987), Macaulay duration (1938) is a fundamental concept and represents the

price elasticity of a bond to changes in the interest rate. In the 1970s, Fisher & Weil (1971) criticize how the Macaulay duration was calculated and develop the Fisher-Weil duration.

2.   Research Objectives

At a time when financial markets are increasingly volatile and that their impact on the results of Financial Institutions is increasing, it is important to study the perception of how Financial Institutions capture and hedge interest rate risk.

That said, it should be noted that this paper is focused precisely on interest rate risk and the methods by which this risk is mitigated by Financial Institutions. Various theories regarding this topic are to be presented and discussed, in order to support analysis to be done after this case study. In this paper, based on market prices of Portuguese bonds and German bonds, we will test the quality of interest rate risk immunization using the Fisher & Weil (1971) duration.

Portuguese bonds and German bonds were selected due to their stance at opposite sides regarding credit risk. Currently Portugal is seen as an investment with a high credit risk, while Germany is considered as the safest investment in Euro Zone.

It is intended to verify if the instability of the credit risk in the Euro Zone allows interest rate risk immunization using the concept of Fisher & Weil (1971) duration.

Later, based on interviews with those responsible for the interest rate risk at Financial Institutions, we will make conclusions about the way interest rate risk immunization is carried out in financial markets.

In the end, interest rate swaps will be introduced as a method used by Financial Institutions to hedge interest rate risk.

3.   Literature review

In this section we will conduct a review of the financial literature on various topics regarding interest rate risk in order to analyze the quality of interest rate risk immunization using Fisher & Weil (1971) duration.

Initially we address issues such as interest rate risk and its implications for Financial Institutions. Later we define the concept of duration as an approximation for calculating the bond price after a change in interest rates in the financial market.

At the end of this section, we analyze the main models of interest rate risk immunization, with special emphasis at interest rate risk immunization using Fisher & Weil (1971) duration.

These concepts are critical to the performance of the case study and its conclusions. Based on Fisher & Weil (1971) duration we will test its applicability in interest rate risk immunization, using market prices of Portuguese bonds and German bonds.

3.1. Interest Rate Risk in Financial Institutions

One of the most important sources of risk in Financial Institutions is the interest rate risk which arises from the uncertainty regarding future interest rates. Fooladi & Gordon (2000) define the business sector and speculation as the main sources of the interest rate risk in Financial Institutions, stating that:

•   Speculation is related to a bet made on the forecast of future interest rates. Thus, a forecast of lower interest rates in the future, investment must be made in bonds at fixed interest rates, in order to maximize the expectation of interest received. Given an opposite prediction of the movement in interest rates in the future, investment must be made in bonds at floating interest rates to track the rise in the interest rate. Regarding financing of Financial Institutions and forecasting a drop in interest rates in the future, funding should be conducted at a floating interest rate to minimize the expectation of interest paid. Given an opposite prediction of the movement in interest rates in the future, funding should be made at fixed interest rate in order to minimize the interest paid.

•   By definition, the business sector of Financial Institutions, which is based on the trade-off between credit and deposits, the mismatch that may exist between the type of interest rate of assets[1] and liabilities[2] can cause high volatility in cash flows when the term structure of interest rates change.

Thus, the interest rate risk is the risk that results from an unfavorable change in interest rates in the financial market, resulting in a negative impact on the results of the Financial Institutions.

Pinheiro & Ferreira (2008) studied the speculation ability of Financial Institutions between 1980 and 2003 (having analyzed 371 Financial Institutions). According to the sign of the duration gap[3] a Financial Institutions have a forecast of interest rates in the future. Thus, a positive duration gap is a bet on rising interest rates in the future. In the opposite, a negative duration gap is a bet on falling interest rates in the future. They concluded that, in general, Financial Institutions failed to forecast interest rates in the future. This means that when Financial Institutions had a positive duration gap the interest rates on the

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[1] A resource with economic value that a corporation owns or controls with the expectation that it will provide future benefits;

[2] A corporate legal debts or obligations that arise during the course of business operations;

[3] Asset duration less liability duration. Asset duration is the average duration of the portfolio's assets and liabilities duration is the average duration of the portfolio's liabilities.

financial market fell, and when duration gap was negative interest rates in the financial market rose. Both scenarios lead to losses in the financial statements of Financial Institutions.

Thus, Pinheiro & Ferreira (2008) suggest an active approach in interest rate risk immunization, reducing the volatility of cash flow and results of Financial Institutions.

Smith & Stulz (1985) argue that interest rate risk immunization is a way to create value for Financial Institutions. The main benefits identified by the authors are:

• The tax benefit in the Financial Institutions, because it allows the reduction of earnings volatility;

• Reducing the credit risk and therefore the probability of bankruptcy. This benefit is due to the reduction in the volatility of cash flows, and

• The reduction of agency costs, ie, reducing conflicts between management and stakeholders.

Froot et al. (1993) add that interest rate risk immunization allows funding at lower interest rates. This decrease in the cost of funding is associated with reduction of credit risk taken by creditors.

Pennings & Leuthold (2000) consider that the future contracts can develop a relationship of trust between the Financial Institutions.

Then, Pinheiro & Ferreira (2008) describe the main methods used to calculate the interest rate risk exposure of Financial Institutions:

• Funding gap is described as the allocation of assets and liabilities based on different maturities. This method is limited because book values are used and intermediate cash flow are neglected, as is the case of interest and repayment of capital; and

• According to the authors, the gap duration method involves calculating the duration of assets and liabilities. In section 4. we identify the limitations of the duration gap as an indicator of the interest rate risk.

Pinheiro & Ferreira (2008) refer to the increasingly important role of interest rate derivatives in the hedging strategy, with particular emphasis on the interest rate swap. The authors argue that this instrument allows for better adaptation to the needs of Financial Institutions and provide a better quality interest rate risk immunization.

Brewer III et al. (2001) argue that the flexibility of the interest rate swap allows Financial Institutions to adapt the portfolio to the forecast of interest rates in the future by exchanging a fixed interest rate for a

variable interest rate, and vice versa. It does not require initial investment from Financial Institutions.

In the case study presented in section 6. we will use the duration gap to test the quality of the interest rate risk immunization based on a portfolio consisting of Portuguese bonds and German bonds. In the same section we introduce interest rate derivatives as a hedging instrument used by Financial Institutions.

3.2. Bonds Duration

The duration is quite an old indicator in financial literature. Initially presented by Macaulay (1938), the duration is an indicator of the average time a bond needs to create its value.

The Macaulay duration is assumed based on two assumptions:

• Term structure of interest rates are constant for all maturities; and

• Changes in the term structure of interest rates are parallel.

Macaulay duration is then, on that basis, calculated as follows:

$$D_{MAC} = \frac{\sum_{t=1}^{N} \frac{t\,C_{(t)}}{(1+r)^t}}{P_0} \qquad (1)$$

Where $C_{(t)}$ is the cash flow received in t, r is the discount factor of cash flows and P_0 is the bond price.

This means, according to the formula shown, that bond duration is a weighted average of maturity of each of their cash flow. The weighting given to each of the maturities is equal to the proportion of the value of the bond that is equal to the cash flow that occurs at that maturity.

Later, Fisher & Weil (1971) expanded on the concept of duration which Macaulay had created. The Fisher-Weil duration requires only one assumption:

• Changes in the term structure of interest rates are parallel.

Unlike the concept of Macaulay duration, Fisher & Weil duration considers different interest rates for different maturities.

The Fisher & Weil formula duration is similar to Macaulay duration, except the cash flows of different periods are discounted using different interest rates. Thus, the Fisher & Weil duration is better suited to the financial market (see section 4.1. which includes analysis of the Term Structure of Interest Rates).

Fisher & Weil duration is calculated using the following formula:

$$D_{FW} = \frac{\sum_{t=1}^{N} \frac{t\,C_{(t)}}{(1+r_{tj})^t}}{P_0} \qquad (2)$$

Where $C_{(t)}$ is the cash flow received in t, r_{tj} is the discount factor of the cash flow in period t and P_0 is the bond price.

Macaulay duration is a particular case of Fisher & Weil duration when $r_{0,1} = r_{0,2} = \ldots = r_{0,T}$, i.e. when the term structure of interest rates is constant for all maturities.

In the case study (section 6.) we use Fisher & Weil (1971) duration to test the quality of interest rate risk immunization using market prices of Portuguese bonds and German bonds.

Soon after the presentation of the concept by Macaulay, Hicks (1939) developed the interpretation of duration as a measure of price elasticity of the bond against movements in the term structure of interest rates.

Much later, with the work of Hopewell & Kaufman (1973), we arrive at the following expression to get the bond price when the term structure of interest rates changes:

$$\Delta P_0 = -D \frac{\Delta r}{(1+r)} \qquad (3)$$

Where D is the duration, r is the interest rate and P_0 is the price of the bond.

The analysis of this formula allows us to conclude that the duration of a bond indicates the percentage decrease in its price when the interest rate increases 100 basis points (1%). Thus, if interest rates increase (decrease) the value of the bond decreases (increase).

The interest rate risk decreases if the amount of exposure or duration of the portfolio is reduced.

Duration is a measure of the bond price sensitivity to movements in the interest rate. There are three drivers which influence the duration value and, consequently, the interest rate risk:

- The duration increases with maturity, but at a decreasing rate:

$$\frac{\partial D}{\partial n} > 0 \quad \text{and} \quad \frac{\partial^2 D}{\partial n^2} < 0$$

- The duration decreases with the increasing level of interest rates, because the discount factors decrease more sharply for longer periods than for short periods:

$$\frac{\partial D}{\partial r} < 0$$

- The duration decreases with the increasing coupon rate of the bond, because the weight of cash flows increases over the nominal value.

The properties of the duration will allow us to understand the result obtained in the case study. The yield to maturity, maturity and coupon rate of the Portuguese bonds and German bonds are important indicators for the conclusions of the outcome of interest rate risk immunization.

3.3. Interest Rate Risk Immunization using Bonds Duration

An interest rate risk immunization strategy aims to ensure, in the present moment (time "0") that at the end of a given investment time horizon ("h" periods), and regardless of any developments that will occur concerning interest rates, the future value of the portfolio is at least equal to the value that would be obtained if interest rates did not change. This means that the total return rate of the portfolio is at least equal to that which would be obtained in a scenario of stable interest rates.

Because it is not necessary to have a vision of the future term structure of interest rates, interest rate risk immunization using duration is considered a passive strategy, which is very useful in a scenario of high volatility of interest rates.

Early versions of interest rate risk immunization using duration were created by Samuelson (1945) and Redington (1952). Later, interest rate risk immunization was demonstrated by Fisher & Weil (1971), using the following condition:

- A portfolio is immunized against any change in interest rates if its duration is equal to the investment time horizon.

Therefore, when investment time horizon is equal to Fisher & Weil duration, we have:

$$S_h^c \geq P_0^c \cdot (1+i_h)^h \quad e \quad TRR_h \geq i_h$$

Where P_0^c is the price of the obligation in the period c, i_h is the interest rate at period h and $P_0^c \cdot (1 + TRR_h)^h = S_h^c$.

Bierwag (1987a, Chapter 4) demonstrated the applicability of interest rate risk immunization using duration, by defining two concepts: price risk and reinvestment risk.

Price risk is characterized by the fact that any movement in the term structure of interest rates lead to a change in bond prices. The term structure of interest rates impacts bond prices as it is used in the discounted value of the future cash flows. If the bond is sold before maturity, an increase (decrease) in interest rates is unfavorable (favorable) for the investor as it implies a decrease (increase) in the bond price.

The reinvestment risk is characterized by the fact that any changes in the term structure of interest rates leads to the reinvestment of cash flows at different rates. Thus, an increase (decrease) in interest rates is favorable (unfavorable) to the investor because it creates investment opportunities at higher rates (lower).

Both price risk and reinvestment risk of the bond are the main drivers for the magnitude of interest rate risk.

When Fisher & Weil (1971) duration equals the investment time horizon, the two effects are of equal magnitude and opposite signs, and thus cancel each other out.

Bierwag & Roberts (1990) conducted a study about Canadian bonds between the period 1963 and 1986. They concluded that portfolios with higher duration are more sensitive to interest rate movements and the Macaulay duration explains 80% of the variation in the portfolio value. Later, using the same sample, Fooladi & Roberts (1992) studied interest rate risk immunization using duration. They assumed an investment time horizon of five years, with semiannual portfolio rebalancing. They concluded that interest rate risk immunization using duration was effective.

This information will enable a better understanding of the portfolio created in the case study to hedge interest rate risk.

3.4. Topics used on case study

The concepts presented in this section allow us to achieve the objectives set for the case study.

In this section, we describe the concept 'interest rate risk' and given the nature of the business sector, the Financial Institutions should take an active interest rate risk immunization strategy. We have introduced the concepts of duration and the way this can be used in an interest rate risk immunization strategy.

Based on the presentation of these concepts, we can now apply them, in particular the concept of Fisher & Weil (1971) duration, which is more suited to the reality of the financial market, to create a portfolio in order to hedge interest rate risk. This portfolio will be created using Portuguese bonds and German bonds.

The purpose of the case study is to verify if the Fisher & Weil (1971) duration is effective in implementing interest rate risk immunization, regardless of the issuer of the bonds and the credit risk volatility in financial markets.

4. Limitations of Bonds Duration

In section 3. we introduced the concept of duration as an indicator of interest rate risk. The duration has been the target of several complex studies and is difficult to implement in practice. Following from the above in this section, we can also add that Fisher & Weil (1971) duration is best known in financial literature and the most used in financial markets.

In this section we discuss the main limitations of duration as an approximation to the bond price, which is important because it will duly justify the results obtained in the case study.

4.1. Term Structure of Interest Rates

As mentioned, the concept of duration was introduced by Macaulay (1938) and was based on two assumptions:

•   Term structure of interest rates are constant for all maturities, and

•   Movements at the term structure of interest rate are parallel.

The first assumption Macaulay relied on, keeping term structures constant for all maturities, is not realistic because it is easy to see that interest rates change depending on the different maturities.

In the next graph we can observe the term structure of interest rates on 22 October 2012:

Figure 1 - Term Structure of Interest Rate

(Source: Bloomberg)

As we can see the term structure of interest rate currently assumes a crescent shape. This means that investors require a higher interest rate as the maturity

increases, i.e. the greater the period, the greater the interest rate required by the investor.

Based on financial market information (see graph above) we conclude that it is not possible to guarantee an adequate interest rate risk immunization using the Macaulay (1938) duration, because it assumes a fact that is not the present in the financial market today.

The Fisher & Weil (1971) duration is better suited to financial market conditions, since it does not assume a constant term structure of interest rate. For this reason the case study is performed using the Fisher & Weil (1971) duration.

4.2. Parallel Movements in the Term Structure of Interest Rate

The assumption made by Fisher & Weil (1971), which is that movements in the term structure of interest rates are parallel, is not characterized by what is happening in the financial markets. Movements in interest rates may take different magnitudes and opposite directions in different maturities. In the next graph we can see the change of the term structure of interest rates from the 15th to 19th October 2012:
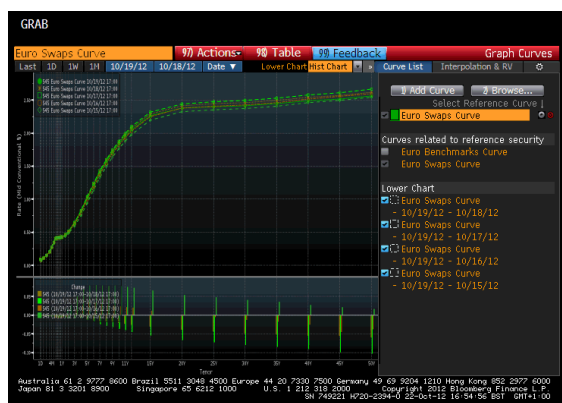
Figure 2 – Movements in the Term Structure of Interest Rate

(Source: Bloomberg)

As can be seen, the change of the term structure of interest rates was more significant in the long term compared to short term. In the long term there is volatility in the interest rate, while the short-term interest rates remained unchanged.

Based on financial market information (see graph above), we conclude that the movements of the term structure of interest rates are not parallel. The concept of parallel movements may, however, be useful for creating stress test scenarios. Based on variations of

the same magnitude in the short and long term of the term structure of interest rate (usually +/- 100 Basis Points) it is possible to get extreme scenarios of interest rates and calculate their impact on the results of Financial Institutions.

4.3. Infinitesimal Movements in the Term Structure of Interest Rates

Duration can be a good indicator of bond price sensitivity for infinitesimal movements in the term structure of interest rates. However, in financial literature there is no definition for what is considered to be an infinitesimal change of the term structure of interest rates. Sometimes we can see high volatility in the term structure of interest rates in the financial markets. Consider the following graph with the term structure of interest rate movements between the 26th to the 29th of September 2008 (Friday to Monday):

Figure 3 - Volatility in the Term Structure of Interest Rates

(Source: Bloomberg)

This term structure of the interest rate movements is related to the feeling of distrust between Financial Institutions that has developed in the financial markets after the collapse of Lehman Brothers in September 2008.

Duration is the first derivative of the relationship between bond price and interest rate. When there are big movements at the term structure of interest rates, using duration as an approximation of the bond price will not be efficient. Huge differences will arise between this approximation of the bond price and the bond price in financial markets.

Convexity is a measure of sensitivity of the bond duration to changes in interest rates. It is the second derivative of the relationship between the bond price and interest rates. It measure how the bond duration changes as interest rate changes.

In the following graph we can see the relationship between bond price and interest rate:

Figure 4 - Relationship between the Bond Price and the Interest Rate

(Source: Hull 2003)

When the interest rate varies from r_0 to r_0^+, the variation in the bond price is ΔP_0. When using duration to calculate the bond price, we calculate the change in bond price that would occur if the relationship between the interest rate and the bond price was linear. This means that we are moving along the tangent to the curve of the bond price, rather than along the curve itself.

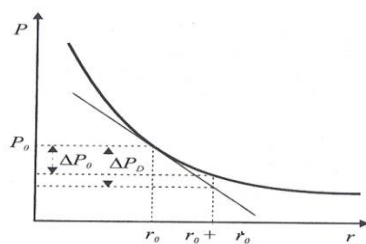For small movements in r_0, the tangent line is a good indicator of the bond price. However, for high movements in r_0, the error in the bond price is raised if the tangent line is used for calculating the bond price. The bond price error is the difference between ΔP_D and ΔP_O.

Using both duration and convexity the approximation to the bond price will be more accurate to the bond price in financial markets.

In the case study we chose to use only the Fisher & Weil (1971) duration. This option is related to the complexity that is obtained by using the convexity to hedge interest rate risk. In addition, the use of convexity would not bring additional conclusions to the case study.

4.4. Impact of "Time" in the Bond Duration

The Macaulay and Fisher & Weil duration overlook the impact that "time" may have at calculating a bond price.

The effect of "time" shows that the bond price changes despite the fact that the term structure of interest rates remains unchanged. This happens because the present value of future cash flows is greater as we approach maturity.

The discount factor used to calculate the present value of future cash flows from the bond change according to the term structure of interest rates. Even if we maintain a fixed term structure of interest rates, the discount factor decreases as we approach the respective maturity of the bond.

Rakotondratsimba & Jarjir (2008) demonstrate the impact of "time" in bond price. They concluded that the approximation to the bond price, using duration can lead to significant errors and suggested adding a residual term that reflects the "time" of the bond.

In order to reduce this impact in the case study we choose to conduct quarterly rebalancing of the portfolio.

4.5. Proportions of Bonds *vs.* Nominal Amount of Bonds

Academic examples about interest rate risk immunization are carried out using proportions of bonds regardless of nominal amount per bond.

In the financial market, we can find bonds with different nominal amounts. The most common are bonds where the nominal amount of each bond is a thousand currency units, which involves the purchase/sale of bonds in multiples of thousand units which thereby may affect the quality of interest rate risk immunization.

The following illustration is a bond issued by Portugal in August of 2012:

Figure 5 - Treasury Bills

(Source: Bloomberg)

Portugal intends to get cash inflow of EUR 960 Million. For that issued 1 billion of treasury bills with a nominal amount of EUR 1. Thus, the purchase/sale of treasury bills has to be in multiples of a unit.

In the case study (section 6.) Portuguese bonds and German bonds were selected with a nominal amount of EUR 0.01.

4.6. "Embedded Derivatives" in Bonds

The Macaulay and Fisher & Weil duration overlooks the impact of embedded derivatives on bond duration. However, the existence of embedded derivatives affects the quality of approximation to the bond price.

The evolution of financial engineering created bonds with embedded derivatives. The most used

derivatives on bonds are call options and put options, which allows the issuer/holder of the bond to collect repayment/prepayment before maturity.

Consider the following example that led to the financial crisis started in the United States in 2007. Mortgage-backed securities are bonds where the investor's return depends on the development of a mortgage credit portfolio. Based on a reduced duration of these bonds (neglecting the existence of an embedded derivative) investors thought that exposure to interest rate risk was low. However, when interest rates rose, many borrowers failed to pay their mortgage credit and investors in mortgage-backed securities recorded losses substantially higher than they expected.

Given the limitation of the duration on bonds with embedded derivatives, Bierwag (1997) developed the option-adjusted spread model, which consisted of calculating a spread that would be used to discount cash flows from a bond. A higher spread indicates a higher sensitivity and, therefore, higher price volatility with respect to interest rate movements.

In the case study (section 6.), bonds without embedded derivatives were selected in order to only conclude about the impact of credit risk in the quality of interest rate risk immunization.

4.7. Transaction Costs inherent in Bonds

Transaction costs are present in every trade in financial markets. Therefore, while this point does not correspond to a limitation of the duration, is it nevertheless inserted in this section because transaction cost impacts the quality of interest rate risk immunization. The main transaction costs are:

- Fees charged on purchase/sale of bonds, and

- Custodian costs charged by an agent for holding company's assets.

Portfolio rebalancing should be done regularly in order to maintain equality between the duration portfolio and the investment time horizon. However, the frequency of portfolio rebalancing must take into account the transaction costs which influence the quality of interest rate risk immunization.

In conducting the case study (section 6.), we do not consider transaction costs as they do not influence the conclusions.

4.8. Topics used on case study

This section assumes a particularly significant importance in the case study because it permits an understanding of the portfolio created for interest rate risk immunization.

In this chapter we may indeed see the main limitations of duration. In conducting the case study we can eliminate/reduce the impact of the following limitations:

- Term structure of interest rates, as we used the concept of Fisher & Weil (1971) duration;

- Impact of "time" in bond duration, which was reduced by performing a higher frequency of portfolio rebalancing (in the case study we perform quarterly portfolio rebalancing);

- "Proportions of bonds *vs*. Nominal amount of bonds", which was eliminated by selecting bonds with nominal amount of EUR 0.01, and

- "Embedded Derivatives", which were eliminated by selecting bonds without embedded derivatives.

In the conclusions of the case study we consider the limitations of the duration that were not eliminated/reduced:

- Parallel movements in the term structure of interest rate;

- Infinitesimal movements in the term structure of interest rates, and

- Transaction costs of bonds.

5.   Credit Risk in the Euro Zone

In the case study we intend to demonstrate that the credit risk is the main limitation on the quality of interest rate risk immunization using Fisher & Weil duration. In this regard, Portuguese bonds and German bonds have been selected because they are on opposite sides of credit risk in Euro Zone. On one side we have Portugal, where credit risk reached high levels in recent years. On another side is Germany, where credit risk decreased considerably. However, in both cases we have seen credit risk volatility in recent years.

Credit risk is associated with uncertainty about the future cash flows of a bond. In an adverse economic scenario there is a possibility that an issuer of bonds cannot meet their obligations, including payment of interest and the reimbursement amount at the maturity of the bond.

In this section we will study the credit risk present in bonds issued by Portugal and Germany. Topics about credit risk will be discussed, such as credit spread practiced on credit derivatives, credit ratings assigned by major rating agencies and yield to maturity of bonds.

5.1. Credit Spread practiced in Credit Derivatives

A credit default swap is a contract where the buyer of the swap makes payments up until the maturity date of a contract. Payments are made to the seller of the swap. In return, the seller agrees to pay off a third party debt if this party defaults on the loan. A credit default swap is considered insurance against non-payment.

In the following figure we can see a credit default swap when there is no default of the third party:
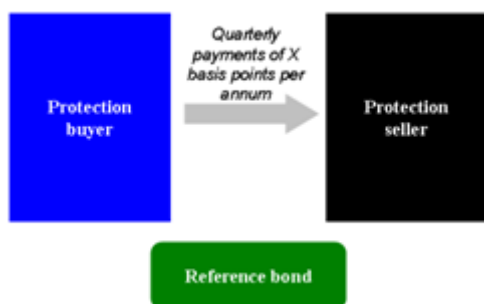
Figure 6 – Credit Default Swap (No Default of the third party)

(Source: Markit)

In the next figure we can see a credit default swap when there is a default of the third party:
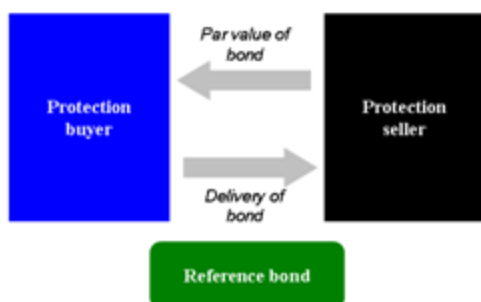
Figure 7 - Credit Default Swap (Default of the third party)

(Source: Markit)

Credit default swaps are used to protect the ability of a third party to fulfill their financial obligations. Thus, the higher the probability of default of a third party the greater the interest rate seen in the financial market to buy protection. The spreads found for credit default swaps have become an indicator to measure the credit risk of a third party.

Despite being traded over-the-counter[4], we have seen an increasing standardization of credit default swaps which facilitates the comparison of credit risk among the reference entities.

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[4] A security traded via dealer network as opposed to on a centralized exchange.

Based on spreads realized on credit default swaps between 2010 and 2012, we present the evolution of the credit curve for debt issued by Portugal and Germany:
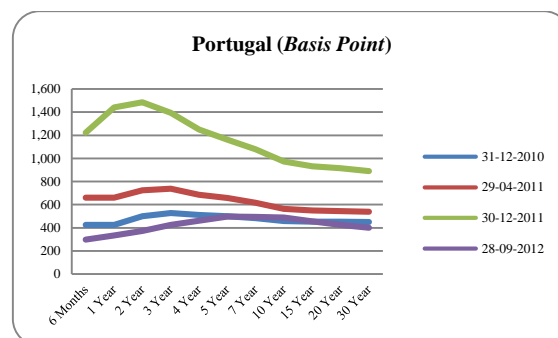
Figure 8 - Credit Curve of Portugal

(Source: Markit)

Currently we have seen tremendous volatility in spreads practiced on credit default swaps for Portugal. This means a higher bond price volatility and, consequently, the respective quality of interest rate risk immunization.
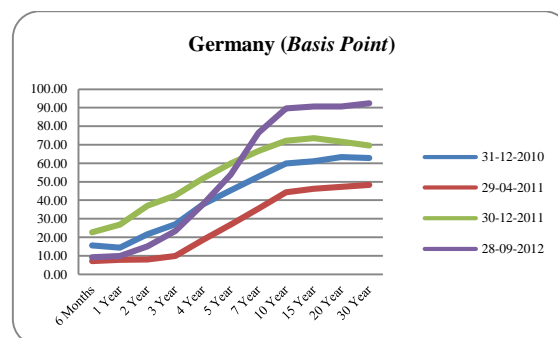
Figure 9 - Credit Curve of Germany

(Source: Markit)

Spreads seen on credit default swaps for Germany are the lowest in the Euro Zone. Despite the slight increase in late September 2012, the spreads do not exceed the barrier of 100 basis points.

Credit risk in bonds has a strong impact on its cash flows and its duration. Facing a high credit risk, there could be two plausible scenarios which result in partial/total default and bond restructuring. In a scenario of partial/total default the duration decreases considerably due to the declining cash flows received. On the other hand, in a scenario of bond restructuring, the duration increases due to the extension of the bond maturity.

Both Macaulay and Fisher & Weil duration overlook the credit risk in a bond and its impact on the approximation to the bond price. Fooladi et al. (1997a) claim that the use of Macaulay and Fisher & Weil duration should be limited and suggest introducing an adjustment of credit risk.

Given these considerations, the following questions arise: What characterizes a bond without credit risk? Can we identify a bond which will never have credit risk?

An asset is considered credit risk free whenever it is possible to predict its cash flows with a high degree of confidence. In these cases a default scenario is not a possibility.

Thus private companies cannot be considered free of credit risk, since even the largest companies have always default risk (although it may be reduced). Take as an example the collapse of Lehman Brothers and its impact on the financial sector.

Securities issued by governmental entities are the only bonds able to be considered without credit risk. This is due to the fact that governments can control some economic mechanisms, as is the case of monetary and tax policy, which helps to significantly increase the likelihood of fulfilling their responsibilities.

However, currently we can observe high credit risk in the sovereign debt of some countries. Portugal, which was once considered an investment without credit risk, now cannot finance its debt at sustainable interest rates. Germany, which today is considered the safest investment in the Euro Zone, was considered a high risk investment after the Second World War. The definition of an asset without credit risk should be framed in time.

Since the beginning of the single currency – the Euro, Portugal has no control of monetary policy (the power of issuing money). Although Portugal has tax autonomy to pursue the objective of fulfilling their financial responsibilities, as can be seen in the next graph, the credit risk in Portugal is very high when compared with the credit risk of Germany. Currently, the Portuguese credit derivatives are traded with a coupon rate that is very high and very volatile. On the other hand, German credit derivatives are traded with a low coupon rate, however it has some volatility. In this graph, we can see the difference between the credit curves of Portugal and Germany in 2012:
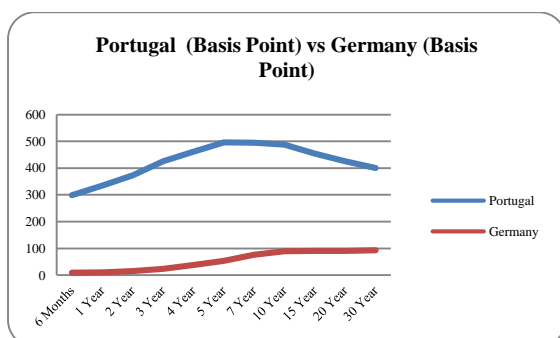
Figure 10 - Credit Curve of Portugal and Germany

(Source: Markit)

Thus the need to respond to the following questions arises: Is it possible to make an interest rate risk immunization using Portuguese bonds and German bonds? Or the volatility of the credit risk prejudice the quality of immunization?

In the case study we will test the quality of the interest rate risk immunization using Fisher & Weil duration and creating a portfolio with Portuguese bonds and German bonds.

5.2. Credit Ratings of the Issuers

In the work of Babbel et al. (1999) it is suggested that the formula of duration should include an adjustment factor that reflects the credit risk of the issuer. Each credit rating class is assigned an adjustment factor which is related to the volatility of the yield to maturity of its bonds.

The rating assigned by the specialized agencies is becoming increasingly important in financial markets. Despite strong criticism that the rating agencies have been influenced by the media and investors[5], the truth is that the financial market continues to use their analysis as a base of credit risk of the issuers.

Through ratings, a probability of default of the issuer of the bond is assigned. An issuer with a high rating has a reduced probability of default and thus a low credit risk. In contrast, an issuer with a low rating has a high probability of default and consequently a higher credit risk.

In the following table we can see the evolution of the credit rating of Portugal and Germany assigned by Standard & Poor's and Moody's:

Entity	Date	S&P Rating	Fitch Rating
Portugal	21-01-2009	A+	AA
Portugal	24-03-2010	A+	AA-
Portugal	27-04-2010	A-	AA-
Portugal	23-12-2010	A-	A+
Portugal	24-03-2011	BBB	A+
Portugal	24-03-2011	BBB	A-
Portugal	29-03-2011	BBB-	A-
Portugal	01-04-2011	BBB-	BBB-
Portugal	24-11-2011	BBB-	BB+
Portugal	13-01-2012	BB	BB+

Figure 11 - Credit Rating of Portugal

(Source: Bloomberg)

[5] In Australia a Federal Court punished Standard & Poor's for assigning the maximum rating (AAA) for assets of dubious quality, known as toxic assets. Those assets led to the financial crisis started in 2008 in United States.

Since 2009 we have seen several downgrades for Portugal debt. Currently, Portuguese debt is considered a Junk Bond by major rating agencies.

Entity	Date	S&P Rating	Fitch Rating
Germany	17-08-1983	AAA	N/A
Germany	10-08-1994	AAA	AAA

Figure 12 - Credit Rating of Germany

(Source: Bloomberg)

Germany has the highest rating and is considered a safe investment in the Euro Zone.

5.3. Yield To Maturity of Bonds

Yield to maturity is an indicator of the credit risk to the extent that the higher the risk, the higher the return required by investors. Thus, issuers with less credit risk in the financial market issue bonds with a low yield to maturity. In contrast, issuers with greater credit risk issue bonds on the financial market with higher yield to maturity.

The evolution of the yield to maturity on the secondary market depends on the perception of credit risk of the issuer. Later on we will analyze the volatility of yield to maturity of Portugal and Germany and conclude on the impact that may exist in the quality of interest rate risk immunization.

In the next graph we can observe the yield to maturity of Portugal and Germany from 2004 to 2012:
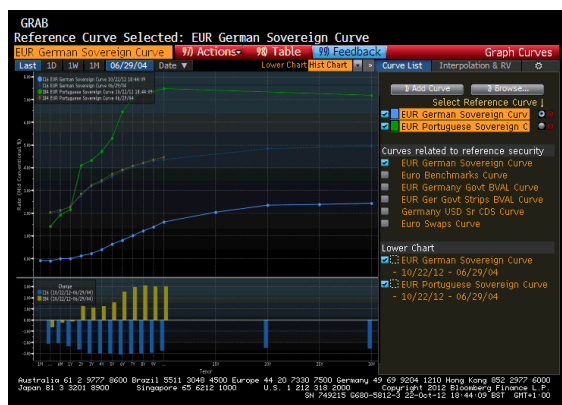
Figure 13 - Yield Curve of Portugal and Germany

(Source: Bloomberg)

In 2004 the yield to maturity of Portugal and Germany were similar in different maturities. However, currently the Portuguese yield to maturity increased significantly and in contrast, German yield to maturity decreased.

Fons (1990) conducted a study to measure the impact of credit risk in corporate bond duration and concluded that its duration is always shorter than the Macaulay duration. This is because the present value of the cash flow is always less than the actual value of cash flow.

5.4. Topics used on case study

After analyzing the credit spread on credit default swaps, credit ratings and yield to maturity we concluded that Portugal currently has a high credit risk. In contrast, Germany has the lowest credit risk in the Euro Zone.

In addition, we find that there is an inherent volatility of credit risk in both countries, although volatility in German bonds is smaller. The credit risk is reflected in the bond price and its duration.

It was due to this volatility that Portuguese bonds and German bonds were selected to test the interest rate risk immunization. With this, we want to test if the credit risk volatility provides a good quality of interest rate risk immunization.

In the next section, we present the case study and we draw the appropriate conclusions.

6. Case Study: Interest Rate Risk Immunization

Is interest rate risk immunization using Fisher & Weil (1971) duration effective in a scenario of extreme credit risk volatility in the Euro Zone?

With the case study we intend to give an answer to this question. However, before we move to the case study it is necessary to show why interest rate risk immunization is important.

Since the creation of the single currency – the Euro, the financial market has seen high interest rate volatility for different maturities. In the next graph we can see the evolution of Euribor from 1999 until late 2011:
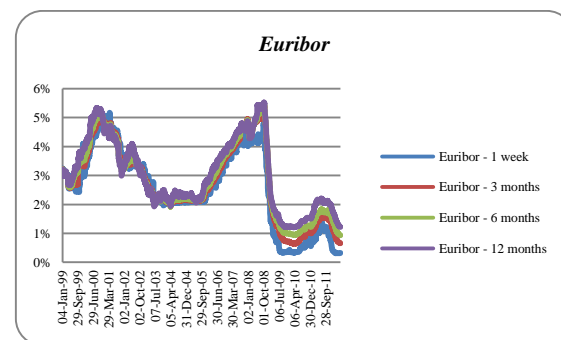
Figure 14 - Euribor

(Source: Bloomberg)

Euribor crossed the 5% twice in late 2000 and the third quarter of 2008. Since then, Euribor fell, reaching a historic low, and at the end of October 2012 the Euribor for 1 Week, 3 Months, 6 Months and 12 Months were 0.079%, 0.197%, 0.385% and 0.611%, respectively.

With the instability in financial markets in recent years, interest rate risk is identified as the main challenge for the Financial Institutions. Considering the Financial Institutions balance sheet, which have in their asset investments at variable interest rate (mortgage credits) and in their liability funding at a fixed interest rate (client deposits), an active interest rate risk immunization has become urgent.

In addition to the interest rate volatility observed in the Euro Zone in recent years, there is also high credit risk volatility. Since the financial crises started in 2008 the Euro Zone has seen successive downgrades from rating agencies, sought financial assistance from the International Monetary Fund and seen a partial default of Greece.

In section 1. we introduced the concept of duration as a measure of approximation to the bond price. The Fisher & Weil duration (see formula (2)), which is more realistic to the financial markets, will be used in the case study.Section 1 also presented the concept of interest rate risk immunization. To this end, we proceeded to define two concepts: "Price risk" and "reinvestment risk". When Fisher & Weil (1971) duration equals the investment time horizon, the two effects underlying these risks are equal and, being of opposite signs, cancel each other out. Thus, a total return rate of the portfolio equal to that which would be obtained in a scenario of stable interest rates is guaranteed.

The concepts of duration, interest rate risk and credit risk created the theoretical and contextual knowledge to proceed with the analysis proposed in this paper, which is the interest rate risk immunization based on the German bonds and Portuguese bonds. Later, interest rate derivatives as a hedging instrument will be introduced as the method used by Financial Institutions.

6.1. Interest Rate Risk Immunization using Fisher & Weil Duration

In order to test the quality of interest rate risk immunization in an environment of high credit risk volatility in the Euro Zone Portuguese bonds and German bonds were selected. As we observed earlier, Portuguese and German debt represent two opposite sides of credit risk in the Euro Zone. Portuguese debt

is considered as a high risk investment and German debt as the safest investment in Euro Zone.

The period between 2005 to 2012 was selected to test the quality of interest rate risk immunization. The aim was to check the quality of interest rate risk immunization before and during the financial crisis begun in 2008, i.e., before and during the period of high credit risk volatility in the Euro Zone.

Thus, through Bloomberg, prices of Portuguese bonds and German bonds were obtained during the period from 2005 to 2012 (in figures 24 to 27 in annex we can see debt issued by Portugal and Germany).

A future liability was introduced to be a benchmark for the development of the portfolio created with Portuguese bonds and German bonds. It has started in March 2005 and will mature in December 2013, with a nominal value of EUR 100 Million.. The interest rates used in the present value of the future cash flows of the liability were taken from Bloomberg (in figure 23 in appendix we can see the present value of the future liability over time).

Based on Portuguese bonds and German bonds, a portfolio was created with identical duration as the future liability. Thus the immunization condition articulated by Fisher & Weil (1971) and demonstrated by Bierwag (1987) is guaranteed.

According to all Portuguese bonds and German bonds available, two Portuguese bonds and two German bonds were selected to ensure the same duration as the future liability (in figures 28 to 31 in appendix we can see a description of the selected bonds).

Based on duration and present value of the future liability in 2005 (duration of 8.8 years and a present value of EUR 72,991,615) and investing in Portuguese bonds and German bonds with the same duration, the objective was, in each period, to ensure the portfolio value was equal to or greater than the present value of the future liability.

On a quarterly basis the portfolio was rebalanced in order to match the future liability duration. The portfolio was bought and sold based on the dirty price[6]. This guarantees the Fisher & Weil duration will be relatively equal to the future liability duration.

The coupons received from the Portuguese bonds and German bonds were included in the portfolio value and invested in the next portfolio rebalancing.

The calculations were carried out in Microsoft Excel and transaction costs were not considered. in order to simplify the calculations.

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[6] A bond pricing quote referring to the price of a bond that includes the present value of all future cash flows, including interest accruing on the next coupon payment.

In figures 32 and 33 in appendix we can see the portfolio details, including nominal amounts, durations and results in each period. The next graph allows us to observe the result over the interest rate risk immunization period:
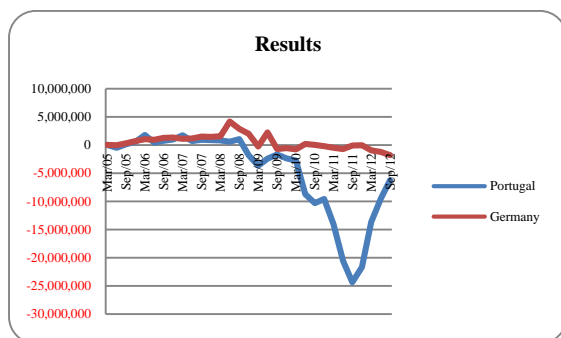
Figure 15 - Results of Interest Rate Risk Immunization

(Source: Author)

As we can see, the result of interest rate risk immunization based on Portuguese bonds and German bonds was negative. In late September 2012, the result of interest rate risk immunization based on Portuguese bonds was a loss of EUR - 6.2 million. The result of interest rate risk immunization based on German bonds was EUR - 1.7 million which, despite being less severe, is still negative.

This means that the portfolio value was lower than the present value of the future liability.

Responding to the question posed at the beginning of the section, the interest rate risk immunization based on Portuguese bonds and German bonds in a scenario of high credit risk volatility was not possible.

As we can see the results of interest rate risk immunization before the financial crisis, which started in 2008 in the United States, was close to zero. Regardless of bonds used in the portfolio (Portuguese bonds or German bonds) it was possible to obtain good quality interest rate risk immunization based on Fisher & Weil (1971) duration. However, since the beginning of the financial crisis (2008) there is some volatility in the results, with particular emphasis on the Portuguese bonds.

We conclude therefore that interest rate risk immunization based on Fisher & Weil (1971) duration is ineffective during a period of high credit risk volatility.

In the following graph we consider the reasons that made it impossible to hedge interest rate risk based on Portuguese bonds and German bonds. For this purpose, the next graph shows the evolution of bond prices throughout the immunization period:
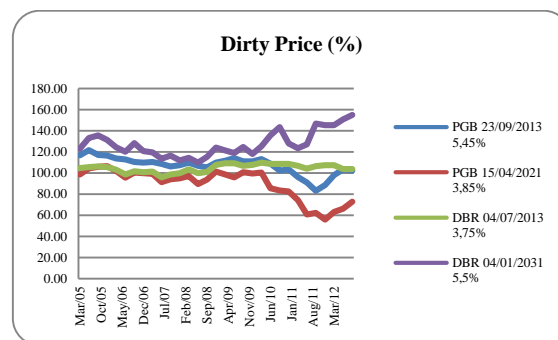
Figure 16 - Evolution of Bond Price

(Source: Bloomberg)

As can be seen, the bonds prices of Portugal and Germany have been very unstable in recent years. Despite some recovery in the last quarter, the price of Portuguese bonds has tended to decline. In the opposite direction, the price of German bonds has increased.

In November 2011, interest rate risk immunization based on Portuguese bonds recorded the worst result of the period (negative, standing at about EUR - 25 million). This period is related to the fall in bond prices registered in the financial market. As we can see, in November 2011 the Portuguese bonds decreased about 40% to 50%.

After this period the bond price rose again. However, the bond PGB 04/15/2021 - 3.85%, which will reach maturity in 2021, is fairly penalized due to the uncertainty being experienced in the financial market for a possible partial default of Portuguese debt in the long term and perhaps a drop of the single currency – the Euro.

The price of the bond PGB 23/09/2013 - 5.45% has a lower default risk because the financial market believe that the aid of International Monetary Fund will continue after 2013. Thus, the default risk is lower in the short term and its price will reach 100% as maturity approach.

For German bond prices, it is worth highlighting the fact that the bond DBR 04/07/2013 - 3.75% will reach maturity in 2013, and because of that, its price is close to par (100%).

The bond DBR 04/0/2031 - 5.5%, maturing in 2031, is being used as a refuge for investors and, because of that, demand has raising the bond price. Note that this increase in the price of German bonds coincides with

the decrease in the price of Portuguese bonds (PGB 04/15/2021 - 3.85%), which means that investors are exchanging Portuguese bonds for German bonds, further pressing the fall in the price of Portuguese bonds and rise in the price of German bonds.

The next graph shows the evolution of the yield to maturity of Portuguese bonds and German bonds between 2005 and 2012:
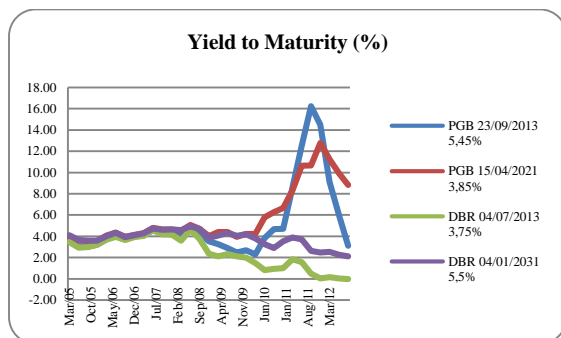
Figure 17 - Evolution of Yields to Maturity

(Source: Bloomberg)

As was expected, the yield to maturity of Portuguese bonds was very volatile and reached high levels in November 2011. This period coincides with the worst result recorded in interest rate risk immunization with Portuguese bonds.

Despite a lower volatility of yield to maturity in German bonds, it has decreased during the immunization period. In September 2012 the yield to maturity of bond DBR 07/04/2013 - 3.75% reached negative values, which means that investors were willing to pay to invest in German bonds.

In the next graph we can see the evolution in the future liability and Portuguese bonds duration during the years 2005 to 2012:
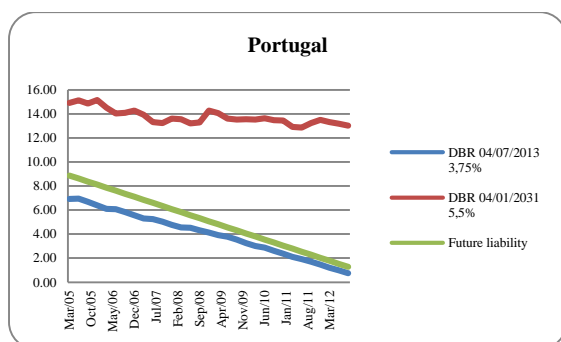
Figure 18 – Bond Duration of Portugal

(Source: Bloomberg)

In late 2007 the Portuguese bonds duration rose slightly. The bond PGB 04/15/2021 - 3.85%, which has a longer maturity, is more volatile because of the uncertainty present in Euro Zone.

Next, we see the same analysis but with German bonds during the years 2005 to 2012:
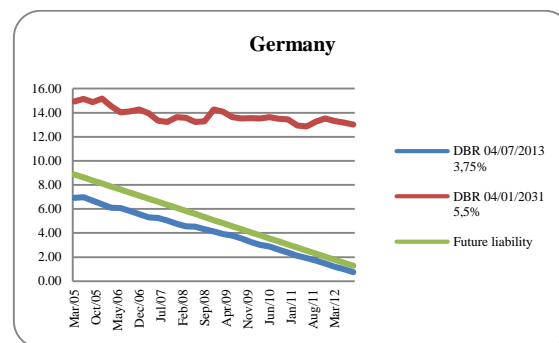
Figure 19 - Bond Duration of Germany

(Source: Bloomberg)

The bond DBR 04/0/2031 - 5.5% registered very unstable behavior throughout the immunization period. This volatility requires a portfolio rebalancing quite often to equalize liability duration with portfolio duration.

In both Portuguese bond and German bond duration, the longer the maturity of the bonds, the greater the duration volatility.

Given the above results, we conclude that interest rate risk immunization based on Fisher & Weil (1971) duration is not effective in periods of high credit risk volatility. Regardless of the bonds used in the interest rate risk immunization, i.e., bonds with high credit risk (e.g. Portugal) or low credit risk (e.g. Germany), interest rate risk immunization using Fisher & Weil (1971) duration is not effective.

The main factor in the failure of interest rate risk immunization is the bond price volatility, originated by changes in the credit risk of the issuer.

The question that arises after the completion of the case study is to know how Financial Institutions manage interest rate risk, considering the fact that interest rate risk immunization based on the Fisher & Weil (1971) duration is not possible in a scenario of high credit risk volatility.

Thus, an interview was conducted among those responsible for managing the interest rate risk in a Portuguese Financial Institution, in order to conclude how the interest rate risk is captured and managed. We intend, therefore, to present a method of interest rate risk immunization effective in an environment of high credit risk volatility.

6.2. Interest Rate Risk Immunization in Financial Institution

The interview was conducted with two traders responsible to manage the interest rate risk in a Portuguese Financial Institution (FI_A), whose

identity is not indicated for reasons of confidentiality of the information provided. Based on this interview, we obtained information that allows us to understand the interest rate risk hedging strategy used in IF_A.

Since the fall of Lehman Brothers in late 2008, we have seen an increase in the cost of funding for Financial Institutions. Currently, with the sovereign debt crisis in the Euro Zone, the funding cost for Financial Institutions is becoming very expensive.

With rising financing costs, Financial Institutions have focused their attention on the cheapest form of financing possible, i.e. client deposits. Competition among Financial Institutions for client deposits is so aggressive that the Bank of Portugal felt the need to intervene through a penalty in the ratio of consumption of capital for Financial Institutions that offer deposits with interest rates higher than the market rate plus 3%.

In the example of client deposits, Financial Institutions incur interest rate risk whenever interest rates decrease in the financial markets, therefore payments of interest incurred on deposits with fixed interest rates do not decrease. Thus, in a falling interest rates scenario, the financial institution is hampered because it has a fixed interest rate for deposits. In a rising interest rates scenario, the financial institution would benefit because interest payments would not rise.

In the first half of 2012, the IF_A had about EUR 6.5 billion in client deposits with a fixed interest rate. Given the exponential increase in client deposits in recent years, it was necessary to adopt an active interest rate hedge strategy. The interview was thus focused on practical examples of hedging the interest rate risk in client deposits.

According to information provided, the hedge of client deposits is accomplished by interest rate derivatives, especially interest rate swaps. The choice of this instrument comes down to its flexibility and because it does not require initial investment (unlike the immunization method using duration, where an investment is required in creating a portfolio).

Another benefit of using interest rate swaps, according to the interviewees, is that this type of instrument is not under credit risk, which makes its present value less volatile. As we have seen in the case study, the bond price volatility was the main cause of the ineffectiveness of interest rate risk immunization.

The credit risk in the interest rate derivatives is mitigated by cash collateral deposited in the Financial Institutions. This method has gained increasing importance in the financial markets and is currently essential to the transaction of derivatives between Financial Institutions.

The next figure describes the interest rate hedging in client deposits:

Figure 20 – Interest Rate Hedging

(Source: Author)

According to interviewees, the interest rate hedge of client deposits is done through an interest rate swap with a counterparty, where IF_A receives a fixed interest rate and pays a floating interest rate. The purpose of this operation is to eliminate the risk of fixed interest rates, getting exposure to a floating interest rate.

This means that an increase in the interest rate leads to a gain in client deposits and a loss on the interest rate swap. If the interest rate decreases, there is a loss on client deposits and a gain on interest rate swap. Through interest rate hedge these two effects are eliminated so that there is no impact on the results of the financial institution, regardless the change in the interest rate.

In order to capture the exposure to interest rate risk, the financial institution department is responsible for managing the interest rate risk, taking a report from an application support with the name of Kondor +. This report allows IF_A to follow the evolution of the interest rate risk and check basis point value of client deposits over different periods.

The concept of basis point value is similar to the concept of Fisher & Weil (1971) duration. However, there is a difference regarding the change in the term structure of interest rates assumed in the calculation. While duration assumes a 1% change in the yield curve, the basis point value assume a change of 0.01%. This means that the basis point value correspond to 1% of its duration.

Thus, the duration limitations identified in section 4. also are applied in the calculation of basis point value, as indicated by the interviewees. Like duration, the maturity and coupon rate are also the main drivers

of basis point value and consequently, the interest rate risk.

According to interviewees, the interest rate risk is based on basis point value. Whenever it is necessary interest rate swaps are negotiated/liquidated to reduce the basis point value gap[7] and consequently reduce the interest rate risk.

The difference in these two methods of hedging is the instrument used to make the interest rate risk immunization. In the case study we perform an interest rate risk immunization based on a portfolio, while in IF_A interest rate risk immunization is based on an interest rate swap.

In the case study, the bond price was very volatile due to the credit risk that affects the quality of interest rate risk immunization. In IF_A, an interest rate swap is used to hedge interest rate risk, and as mentioned by the interviewees, has no credit risk and subsequently its value is less volatile.

As demonstrated in the case study, the credit risk volatility influences the quality of interest rate risk immunization. As interest rate derivatives have no credit risk, Financial Institutions started to use it as a hedging instrument.

The results obtained with the interview allow us to support the conclusion obtained in the case study, which is interest rate risk immunization using Fisher & Weil (1971) duration is ineffective in an environment of high credit risk volatility.

On this basis we can see that interest rate risk immunization is more effective when using interest rate swaps. Having described the process in IF_A interest rate hedge, we present a definition of interest rate swaps in the next section.

6.3. Interest Rate Risk Immunization using Interest Rate Swaps

As was mentioned in the interview conducted with Financial Institutions, interest rate derivatives are important in the process of interest rate hedge. Because of that it is important to explain this instrument more thoroughly.

Financial derivatives are an instrument whose value is linked to or derived from other assets. Their uses are varied from risk management, arbitrage and speculation, depending on the objectives of investors.

Interest rate derivatives are one of the innovations of great importance in the field of financial engineering. Growth has been exponential and the current amount of outstanding contracts is USD 402,611 billion, and

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[7] Basis point value gap is the net of client deposits basis point value and interest rate swaps basis point value.

the interest rate swap is the interest rate derivatives most traded instrument in financial markets.

The following graph shows interest rate swap growth in the last decade:
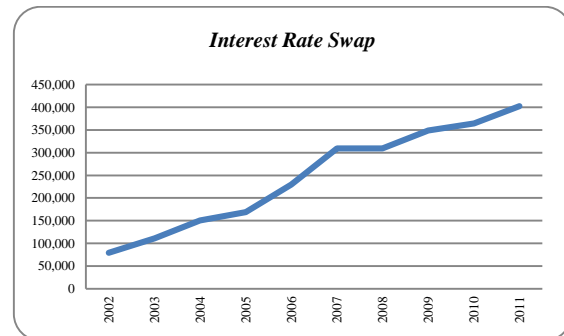
Figure 21 - Growth of Interest Rate Swap (Nominal)

(Source: Bloomberg)

An interest rate swap is defined as a contract in which two parties agree to exchange for a predetermined period of time, two streams of interest payments, each of whose flows are calculated based on different interest rate indices but contain the same reference value, referred to as the 'nominal'.

In the illustration below we can see the cash flows present in interest rate swap:
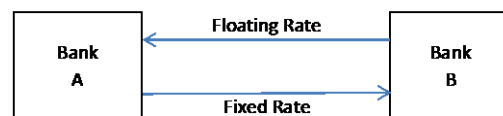
Figure 22 – Interest Rate Swap

(Source: Author)

The use of interest rate swaps gives several advantages such as they:

-      Do not require an initial investment;

-      Are flexible because they are adapted to Financial Institutions needs in terms of maturity, coupons rate and nominal amount, and

-      Contain no credit risk because there is cash collateral between parties.

Interest rate swaps are used as hedging instruments because they allow for the transfer between a fixed rate and floating interest rate.

6.4. Topics from the case study

Upon completion of the case study and after conducting interviews among those responsible for managing the interest rate risk of a Financial

Institution, we are able to point out the main findings of the two methods of interest rate risk hedging.

Both methods used different indicators of the interest rate risk but both have the same interpretation. In the case study we used the concept of Fisher & Weil (1971) duration which showed us the percentage decrease of the bond price when the interest rate increases by 1%. In IF_A the concept of basis point value is used which shows us the percentage increase of the client deposits value when the interest rate increases 0.01%.

The difference between the two methods lies in the instrument used for interest rate risk immunization. In the case study Portuguese bonds and German bonds were used. This method requires a large initial investment (purchase of bonds) and there is higher credit risk volatility, which impacts the quality of interest rate risk immunization.

In IF_A interest rate swaps are used as a hedging instrument. This instrument does not require initial investment and its value is less volatile due to the lack of credit risk, allowing for an effective interest rate risk immunization. Additionally, the interest rate swaps allow for more flexibility for the needs of the Financial Institutions.

Given the above, we conclude that the main difference between the case study presented in this section and the method carried out by the Financial Institutions is basically the hedging instrument used to mitigate the interest rate risk.

7.   Conclusion

The main objective of this paper to determine whether the instability observed in Euro Zone has an impact on interest rate risk immunization strategy.

We start the paper with a review of the financial literature on the subject of interest rate risk, which was defined as an adverse change in interest rates in the financial market, resulting in a negative impact on the results of the Financial Institutions.

Later, the concept of duration was introduced, initiated by Macaulay (1938), as being the average time a bond needs to generate its value. Macaulay (1938) makes two assumptions in the duration calculation:

- Term structure of interest rates are constant for all maturities, and

- Movements in the term structure of interest rate are parallel.

The first assumption made by Macaulay is not suited to the reality of the financial market. In figure 1

(section 4.), a crescent term structure of interest rates was shown.

Later, Fisher & Weil (1971) developed on the Macaulay duration, which took only one assumption:

- Movements in the term structure of interest rate are parallel.

Thus, the Fisher & Weil duration is more realistic in the financial market because the term structure of interest rates is not assumed constant. It is based on the Fisher & Weil duration that was created a portfolio in the case study to hedge a future liability.

The Fisher & Weil (1971) study shows that a portfolio is immunized against a change in interest rates as long as its duration is equal to the investment time horizon. In the case study analysis a portfolio was created in order to match this condition defined by Fisher & Weil (1971).

Bierwag (1987a, Chapter 4) explains interest rate risk immunization through two concepts: Price risk and reinvestment risk. The price risk is characterized by the fact that any changes in term structure of interest rates leads to a change in bond prices and the reinvestment risk is characterized by the fact that any changes in term structure of interest rates leads to reinvestment of cash flows at different rates. When the Fisher & Weil (1971) duration equals the investment time horizon, the two effects are of equal magnitude and opposite signs, thus cancelling each other out. This in turn guarantees a total return rate of the portfolio equal to that obtainable in a scenario of stable interest rates.

In the case study, we tested the applicability of interest rate risk immunization based on Fisher & Weil (1971) duration in an environment of high credit risk volatility. To this end, we selected Portuguese bonds and German bonds due to their contrasting credit risk profiles. While Portugal is considered a high risk investment, Germany is the safest investment in the Euro Zone.

Based on the case study we conclude that the interest rate risk immunization based on Fisher & Weil (1971) duration is not possible in an environment of high credit risk volatility. We found that until mid 2008 it was possible to implement interest rate risk immunization. However, with the financial crisis (started at the end of 2008) interest rate risk immunization using Fisher & Weil (1971) duration was ineffective.

Conducting an interview with those responsible for the interest rate risk management in a Portuguese Financial Institution we found that interest rate derivatives are used as a hedging instrument, in particular interest rate swaps. The choice of this instrument is due to the fact that it does not require an

initial investment and allows for more flexibility to the Financial Institution's needs. In addition, due to the fact that there is no credit risk in interest rate swaps, interest rate risk immunization becomes more effective. Credit risk is mitigated in this instrument because there is cash collateral involved between parties.

8.   Future research directions

After conducting research on interest rate risk immunization, several interesting topics were not developed because it was not the purpose of this paper, are left open through some ideas:

• In the case study we found that the yield to maturity of German bonds reached negative values in September 2012. This means that investors were willing to recognize losses on investments in German bonds. It would be interesting to analyze these yields to maturity on German bonds based on the present economic environment in the Euro Zone. What are the impacts of these yields to maturity in the remaining members of the Euro Zone and the investors themselves?

• Credit ratings, assigned by rating agencies, are indicators of credit risk for particular entities. Given this, and because the rating agencies do not explain the fact that Lehman Brothers, an investment bank which was assigned the highest rating by the several specialized agencies, collapsed in September 2008, it would be interesting to analyze to what extent the ratings assigned by specialized agencies are trustworthy indicators of credit risk and if these agencies are independent and impartial in their credit risk evaluations.

Acknowledgements

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Others:

[24] Bloomberg: Business, Financial & Economic News (information restricted to Financial Services).

[25] Markit: Financial Information Services (information restricted to Financial Services).

Appendix

Figure 23 - Present Value of Future Liability

(Source: Bloomberg)

Date	Duration	Euro Swap Curve	Liability	
			Future	Present Value
31-03-2005	8,88	3,61%	100.000.000	72.991.615
30-06-2005	8,63	3,08%	100.000.000	76.980.615
30-09-2005	8,37	3,15%	100.000.000	77.109.737
30-12-2005	8,12	3,36%	100.000.000	76.476.938
31-03-2006	7,87	3,90%	100.000.000	74.032.524
30-06-2006	7,61	4,18%	100.000.000	73.225.398
29-09-2006	7,36	3,89%	100.000.000	75.520.253
29-12-2006	7,11	4,17%	100.000.000	74.809.929
30-03-2007	6,86	4,25%	100.000.000	75.153.641
29-06-2007	6,60	4,79%	100.000.000	73.424.007
28-09-2007	6,35	4,60%	100.000.000	75.157.756
31-12-2007	6,09	4,58%	100.000.000	76.140.339
31-03-2008	5,84	4,20%	100.000.000	78.662.587
30-06-2008	5,58	5,11%	100.000.000	75.720.612
30-09-2008	5,33	4,71%	100.000.000	78.272.097
31-12-2008	5,07	3,24%	100.000.000	85.070.521
31-03-2009	4,82	2,61%	100.000.000	88.331.653
30-06-2009	4,57	2,77%	100.000.000	88.265.474
30-09-2009	4,31	2,53%	100.000.000	89.781.431
31-12-2009	4,06	2,56%	100.000.000	90.261.503
31-03-2010	3,81	2,02%	100.000.000	92.652.457
30-06-2010	3,56	1,73%	100.000.000	94.090.632
30-09-2010	3,30	1,72%	100.000.000	94.520.636
31-12-2010	3,04	1,88%	100.000.000	94.473.801
31-03-2011	2,79	2,58%	100.000.000	93.127.687
30-06-2011	2,54	2,30%	100.000.000	94.390.326
30-09-2011	2,29	1,54%	100.000.000	96.566.985
30-12-2011	2,03	1,31%	100.000.000	97.382.475
30-03-2012	1,78	1,06%	100.000.000	98.144.036
29-06-2012	1,53	0,83%	100.000.000	98.740.630
28-09-2012	1,28	0,41%	100.000.000	99.479.677

Figure 24 – Treasury Bonds issued by Portugal

(Source: Bloomberg)

Figure 25 - Treasury Bills issued by Portugal

(Source: Bloomberg)

Figure 26 - Treasury Bonds issued by Germany

(Source: Bloomberg)

Figure 27 - Treasury Bills issued by Germany

(Source: Bloomberg)

Figure 28 – Portuguese Bond (ISIN: PTOTEYOE0007)

(Source: Bloomberg)

Figure 29 – Portuguese Bond (ISIN: PTOTEGOE0009)

(Source: Bloomberg)

Figure 30 – German Bond (ISIN: DE0001135176)

(Source: Bloomberg)

Figure 31 – German Bond (ISIN: DE0001135234)

(Source: Bloomberg)

Figure 32 – Interest Rate Risk Immunization using Portuguese Bonds (Values in Euros)

Date	Dirty Price (%)		Fisher & Weil Duration (Years)			Bond Portfólio (%)		Investment Bond Portfólio	Investment Future Liability	Immunization Result	Nominal Amount		Coupon Received	
	PGB 23/09/2013 5,45%	PGB 15/04/2021 3,85%	PGB 23/09/2013 5,45%	PGB 15/04/2021 3,85%	Future Liability	PGB 23/09/2013 5,45%	PGB 15/04/2021 3,85%				PGB 23/09/2013 5,45%	PGB 15/04/2021 3,85%	PGB 23/09/2013 5,45%	PGB 15/04/2021 3,85%
Mar-05	116,87	98,72	6,79	11,95	8,88	0,59	0,41	72.991.615	-72.991.615	0	37.150.859	29.955.422	0	0
Jun-05	121,82	104,28	6,61	11,85	8,63	0,61	0,39	76.493.048	-76.980.615	-487.567	38.613.103	28.247.205	0	0
Set-05	117,15	105,88	6,63	11,57	8,37	0,65	0,35	77.248.370	-77.109.737	138.633	42.684.320	25.730.237	2.104.414	0
Dez-05	116,41	106,49	6,34	11,25	8,12	0,64	0,36	77.088.864	-76.476.938	611.927	42.222.967	26.234.544	0	0
Mar-06	113,84	101,85	6,05	10,82	7,87	0,62	0,38	75.795.797	-74.032.524	1.763.272	41.224.535	28.342.126	0	1.010.030
Jun-06	112,97	95,47	5,78	10,98	7,61	0,65	0,35	73.628.658	-73.225.398	403.260	42.191.803	27.197.654	0	0
Set-06	110,55	100,54	5,82	10,82	7,36	0,69	0,31	76.286.318	-75.520.253	766.066	47.737.365	23.387.082	2.299.453	0
Dez-06	109,87	99,75	5,55	10,49	7,11	0,68	0,32	75.779.314	-74.809.929	969.384	47.213.640	23.963.934	0	0
Mar-07	110,47	99,25	5,31	10,22	6,86	0,69	0,31	76.864.661	-75.153.641	1.711.020	47.676.289	24.378.562	0	922.611
Jun-07	108,76	91,40	5,03	10,24	6,60	0,70	0,30	74.133.773	-73.424.007	709.766	47.586.417	24.485.504	0	0
Set-07	106,11	93,96	5,07	10,09	6,35	0,75	0,25	76.096.149	-75.157.756	938.393	53.427.146	20.649.620	2.593.460	0
Dez-07	107,44	95,09	4,82	9,85	6,09	0,75	0,25	77.035.626	-76.140.339	895.287	53.614.952	20.437.421	0	0
Mar-08	109,83	97,07	4,60	9,69	5,84	0,76	0,24	79.508.321	-78.662.587	845.734	54.813.164	19.892.308	0	786.841
Jun-08	106,69	89,52	4,40	9,85	5,58	0,78	0,22	76.285.716	-75.720.612	565.105	55.978.845	18.503.056	0	0
Set-08	105,24	93,77	4,41	9,75	5,33	0,83	0,17	79.311.055	-78.272.097	1.038.959	62.412.680	14.536.244	3.050.847	0
Dez-08	109,82	101,35	4,20	9,72	5,07	0,84	0,16	83.271.301	-85.070.521	-1.799.220	63.846.340	12.982.796	0	0
Mar-09	111,77	98,51	3,98	9,47	4,82	0,85	0,15	84.651.900	-88.331.653	-3.679.753	64.116.944	13.183.161	0	499.838
Jun-09	114,21	95,94	3,74	9,62	4,57	0,86	0,14	85.873.435	-88.265.474	-2.392.039	64.584.446	12.626.623	0	0
Set-09	111,22	100,85	3,68	9,42	4,31	0,89	0,11	88.085.914	-89.781.431	-1.695.516	70.452.131	9.645.657	3.519.852	0
Dez-09	111,17	99,51	3,38	8,97	4,06	0,88	0,12	87.920.027	-90.261.503	-2.341.476	69.489.196	10.721.423	0	0
Mar-10	113,29	100,57	3,14	8,74	3,81	0,88	0,12	89.918.445	-92.652.457	-2.734.013	69.898.936	10.670.304	0	412.775
Jun-10	109,06	85,52	2,87	8,64	3,56	0,88	0,12	85.357.237	-94.090.632	-8.733.395	68.967.193	11.858.489	0	0
Set-10	102,26	83,56	2,74	8,28	3,30	0,90	0,10	84.190.402	-94.520.636	-10.330.234	74.010.504	10.184.929	3.758.712	0
Dez-10	103,36	82,42	2,50	8,00	3,04	0,90	0,10	84.891.675	-94.473.801	-9.582.126	74.001.796	10.195.849	0	0
Mar-11	96,13	74,21	2,20	7,45	2,79	0,89	0,11	79.098.286	-93.127.687	-14.029.401	72.964.449	12.068.592	0	392.540
Jun-11	91,17	60,79	1,91	7,33	2,54	0,88	0,12	73.859.645	-94.390.326	-20.530.681	71.569.968	14.160.016	0	0
Set-11	83,16	62,16	1,76	7,12	2,29	0,90	0,10	72.219.723	-96.566.985	-24.347.262	78.321.038	11.403.457	3.900.563	0
Dez-11	88,53	55,78	1,54	6,62	2,03	0,90	0,10	75.701.254	-97.382.475	-21.681.221	77.201.628	13.180.281	0	0
Mar-12	98,02	63,07	1,35	6,61	1,78	0,92	0,08	84.496.631	-98.144.036	-13.647.405	79.144.074	10.965.950	0	507.441
Jun-12	103,57	66,25	1,13	6,93	1,53	0,93	0,07	89.234.107	-98.740.630	-9.506.523	80.250.094	9.237.008	0	0
Set-12	102,35	72,82	0,95	6,80	1,28	0,94	0,06	93.237.225	-99.479.677	-6.242.452	86.033.863	7.113.609	4.373.630	0

Figure 33 - Interest Rate Risk Immunization using German Bonds (Values in Euros)

Date	Dirty Price (%)		Fisher & Weil Duration (Years)			Bond Portfólio (%)		Investment Bond Portfólio	Investment Future Liability	Immunization Result	Nominal Amount		Coupon Received	
	DBR 04/07/2013 3,75%	DBR 04/01/2031 5,5%	DBR 04/07/2013 3,75%	DBR 04/01/2031 5,5%	Future Liability	DBR 04/07/2013 3,75%	DBR 04/01/2031 5,5%				DBR 04/07/2013 3,75%	DBR 04/01/2031 5,5%	DBR 04/07/2013 3,75%	DBR 04/01/2031 5,5%
Mar-05	104,74	123,35	6,92	14,92	8,88	0,75	0,25	72.991.615	-72.991.615	0	52.609.389	14.501.836	0	0
Jun-05	105,75	133,36	6,97	15,14	8,63	0,80	0,20	76.948.653	-76.980.615	-31.962	57.998.329	11.707.831	1.972.852	
Set-05	106,15	135,62	6,69	14,88	8,37	0,79	0,21	77.445.589	-77.109.737	335.852	57.970.779	11.729.395	0	0
Dez-05	105,49	131,37	6,40	15,17	8,12	0,80	0,20	77.207.398	-76.476.938	730.460	58.839.824	11.522.621	0	645.117
Mar-06	103,20	124,43	6,11	14,53	7,87	0,79	0,21	75.057.469	-74.032.524	1.024.945	57.559.195	12.584.692	0	0
Jun-06	98,76	120,20	6,07	14,04	7,61	0,81	0,19	74.130.982	-73.225.398	905.584	60.521.346	11.946.640	2.158.470	0
Set-06	101,54	128,41	5,83	14,10	7,36	0,81	0,19	76.792.965	-75.520.253	1.272.712	61.627.651	11.071.855	0	0
Dez-06	100,87	120,91	5,56	14,28	7,11	0,82	0,18	76.157.452	-74.809.929	1.347.523	62.096.470	11.184.396	0	608.952
Mar-07	101,29	119,49	5,31	13,94	6,86	0,82	0,18	76.260.793	-75.153.641	1.107.152	61.806.484	11.430.217	0	0
Jun-07	95,90	113,47	5,24	13,33	6,60	0,83	0,17	74.561.654	-73.424.007	1.137.647	64.650.307	11.069.262	2.317.743	0
Set-07	98,64	116,44	5,03	13,24	6,35	0,84	0,16	76.662.476	-75.157.756	1.504.720	65.221.117	10.585.683	0	0
Dez-07	99,89	111,99	4,78	13,62	6,09	0,85	0,15	77.587.797	-76.140.339	1.447.458	66.171.275	10.258.047	0	582.213
Mar-08	103,48	114,30	4,57	13,57	5,84	0,86	0,14	80.197.762	-78.662.587	1.535.176	66.599.297	9.870.554	0	0
Jun-08	99,93	109,96	4,54	13,22	5,58	0,88	0,12	79.901.543	-75.720.612	4.180.932	70.349.461	8.733.896	2.497.474	0
Set-08	100,99	115,25	4,33	13,29	5,33	0,89	0,11	81.109.537	-78.272.097	2.837.440	71.372.800	7.837.194	0	0
Dez-08	107,80	124,00	4,13	14,28	5,07	0,91	0,09	87.092.135	-85.070.521	2.021.614	73.287.996	6.519.797	0	431.046
Mar-09	109,36	121,46	3,91	14,08	4,82	0,91	0,09	88.068.896	-88.331.653	-262.757	73.305.732	6.503.827	0	0
Jun-09	109,15	118,89	3,79	13,63	4,57	0,92	0,08	90.493.708	-88.265.474	2.228.234	76.341.089	6.029.349	2.748.965	0
Set-09	106,83	124,62	3,54	13,53	4,31	0,92	0,08	89.066.369	-89.781.431	-715.061	76.915.688	5.536.771	0	0
Dez-09	107,73	118,16	3,25	13,56	4,06	0,92	0,08	89.710.404	-90.261.503	-551.099	76.742.366	5.952.515	0	304.522
Mar-10	109,99	125,24	3,01	13,53	3,81	0,92	0,08	91.860.788	-92.652.457	-791.669	77.182.305	5.566.159	0	0
Jun-10	108,63	135,79	2,88	13,64	3,56	0,94	0,06	94.298.245	-94.090.632	207.613	81.354.493	4.359.885	2.894.336	0
Set-10	108,52	143,49	2,62	13,50	3,30	0,94	0,06	94.537.871	-94.520.636	17.235	81.674.657	4.117.761	0	0
Dez-10	108,66	127,98	2,37	13,45	3,04	0,94	0,06	94.246.561	-94.473.801	-227.240	81.453.422	4.482.563	0	226.477
Mar-11	106,96	123,41	2,11	12,93	2,79	0,94	0,06	92.656.776	-93.127.687	-470.911	81.145.400	4.749.543	0	0
Jun-11	104,24	127,06	1,93	12,87	2,54	0,94	0,06	93.663.450	-94.390.326	-726.876	84.829.845	4.121.695	3.042.953	0
Set-11	106,60	146,89	1,70	13,25	2,29	0,95	0,05	96.483.903	-96.566.985	-83.082	85.916.431	3.333.149	0	0
Dez-11	107,45	145,28	1,46	13,52	2,03	0,95	0,05	97.341.208	-97.382.475	-41.267	86.286.948	3.185.303	0	183.323
Mar-12	107,29	145,40	1,21	13,32	1,78	0,95	0,05	97.209.624	-98.144.036	-934.412	86.334.967	3.149.870	0	0
Jun-12	103,70	150,89	1,00	13,19	1,53	0,96	0,04	97.515.445	-98.740.630	-1.225.185	89.969.063	2.798.081	3.237.561	0
Set-12	103,77	155,06	0,75	13,03	1,28	0,96	0,04	97.699.461	-99.479.677	-1.780.216	90.124.863	2.693.812	0	0

Land Evaluation and Agri-Environmental Indicators: Exploring Spatial Trends of Nitrogen Balance in Greece

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Abstract - **The development and application of a suitable methodology for establishing agro-environmental indicators was the aim of this study, according to the new approaches of environmental dimension of the Common Agricultural Policy (CAP) of the European Union. Agro-environmental indicator development is illustrated by a concrete case study of Nitrogen balance at detailed spatial scale (NUTS IV or LAU1) administrative level in Greece. The nitrogen balance is an indicator of the risk posed to the environment from the excess of nitrogen due to the agriculture. The LAU1 analysis of the Nitrogen balance was carried-out in order to identify vulnerable areas in terms of soil and water resources.**

To this end an original methodology has been developed, using information from statistical databases and from Geographical Information System (GIS) in an attempt to answer this question. Vulnerable areas, due to high nitrogen surplus, are identified using this methodology achieving that specific policy measures for environmental protection at the national level can be applied.

This study can be considered as a scale tool informing the reorientation of the CAP, which is directed to transfer support from agricultural products to local incomes and encourage environmentally friendly agricultural activities.

Keywords *– Nitrogen; Common Agricultural Policy (CAP); Nitrogen balance; Fertilizer; Agricultural.*

1. Introduction

Agricultural practices affect in many ways the sustainability of water and soil resources. There are some negative impacts as a result of these practices, which mainly affect crop land where the natural and socioeconomic conditions favour intensive agriculture. It is well known that one of the main harmful impacts in the environment originating from the agricultural practices is caused by the excessive use of fertilizers and pesticides. Excessive and unbalanced fertilization causes environmental pollution and deterioration of the quality of agricultural products. Among fertilizers, the nitrates are soluble to water and therefore are the most responsible for environmental pollution.

The present paper deals with the development of indicators of nitrogen pollution at the municipalities level, based on statistical information on the cultivated land for each kind of crop and each kind of animal bred. The usefulness of the analysis at this geographical level lies in the fact that a more precise detection of the problematic areas arising from the excessive use of fertilizers can be achieved so that the agricultural policy concerning the environment and the quality of the agricultural products will be more effective.

This is the background for adopting policies incorporating environmental objectives in agricultural practices. The Directive of the EU dealing with nitrates (Directive for nitrate pollution 91/676) aims

to reduce the quantities of nitrogen compounds in agricultural soils, and to avoid pollution of ground waters. This policy intends to reduce the present and future nitrogen pollution, and to measure the existing surplus nitrogen, by means of a nitrogen excess indicator as it has been established in the documents COM(2000)20 and COM(2001)144. Indicators are indispensable tools for distinguishing sensitive regions regarding nitrogen pollution.

The estimation of Nitrogen balance thus represents an indicator of agricultural sustainability. Although there is no linear relationship between the excess of nitrogen and the nitrate salts in water, the risk of nitrogen diffusion is higher when local nitrogen excesses are high. For this reason, the estimation of nitrogen excess at local level is necessary for any assessment related to soil waters and the protection of natural recourses.

2.   Methodology and Data Sources

The aim of this project was to introduce an analytical tool using Geographical Information System and statistical data available from existing surveys (Farm Structure Surveys and the Agricultural Census) in order to measure the impact of agricultural activities to the rural environment. The study focused on the nitrogen balance from agricultural activities, at LAU1 level, as an indicator of the risk posed to the environment from excessive nitrogen. The LAU1 analysis of the Nitrogen balance was carried out with the aim of identifying areas of high surplus and thus where surface and ground water may be at risk of contamination.

2.1.   Methodology of nitrogen balance estimation

The nitrogen balance provides useful information regarding the state of nitrogen surpluses.

In the DPSIR (Driving forces, Pressures, State, Impacts, Responses) context, the agricultural surpluses represent an environmental pressure, analogue of raw pollution depended on the yield of the activity. The nitrogen balance at the soil surface is defined as the difference between the total quantity of nitrogen inputs to the soil surface and the quantity of outputs that are released from the soil, annually (1), (Figure 1) :

Nitrogen (N) balance = N input – N output =

N held by the soil + N removal from the soil (1)

The total quality of nitrogen inputs to the soil during the process of agricultural production are those coming from mineral fertilizers and organic manure applied to agricultural land, the fixation by leguminous crops and the wet and dry deposition from the atmosphere. The output (removals) of nitrogen are defined as the nitrogen content of crops removed from the field by harvest or by grazing.
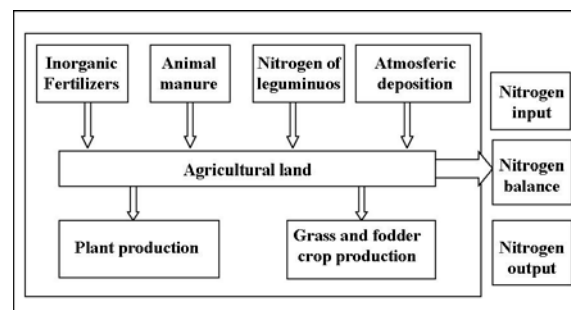

Figure 1. Nitrogen balance in the soil

It is understood that the above estimates are derived by using nitrogen data related only to agricultural practices within the utilized agricultural land. Pollution data referring to industrial wastes, mining activities and urban wastewaters are not considered.

2.2.   Data Sources

The data sources used in this study were:

I.   Farm Structure Survey: Statistical data on cultivated areas by kind of crop and on number of animals at LAU1 were derived from the Basic Surveys of the year 1991 and 1999/2000 (census of the agriculture);

II.   Annual Agricultural Statistical Survey: Statistical data on crop yield by kind of crop at LAU1 level were derived from a national survey using administrative sources;

III.   Corine Land Cover maps: A data base consisting of 16 land cover classes. These data originated from processing of satellite images and the CORINE program (CLC). This file was used mainly for estimation of nitrogen absorbed by pastures for animal grazing (Crouzet, 2000);

IV.   Natura areas: This was a GIS file of Natura 2000 areas which is a complementary one, and allows users to overlay the other information with that of vulnerable areas to nitrogen.

2.3.   Data Base Construction

The above files have been organized and processed into a uniform application of GIS with municipalities cluster spatial level Greek. Maps of the

reference each prefecture have been produced (Figure 2) for input, output and nitrogen balance of the agricultural areas.
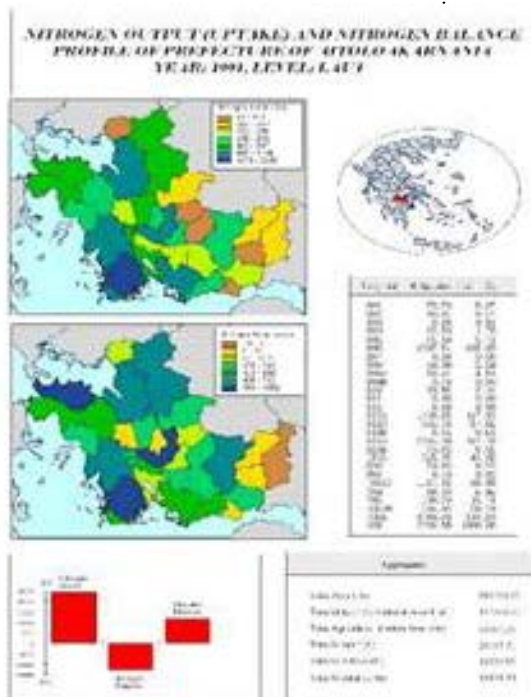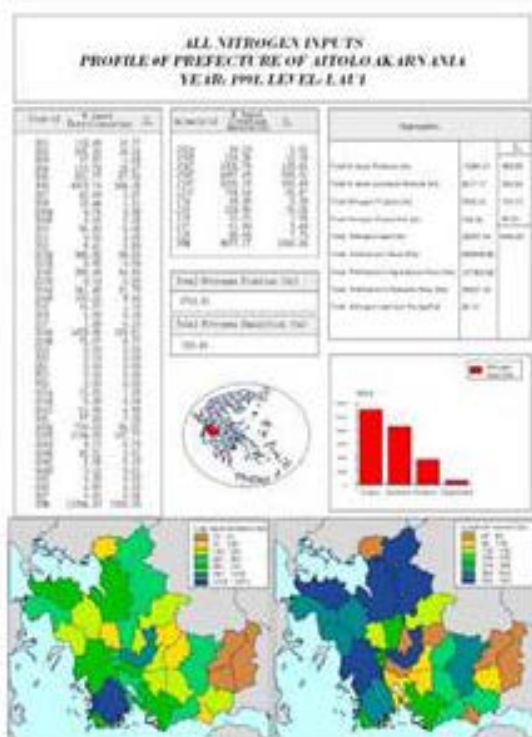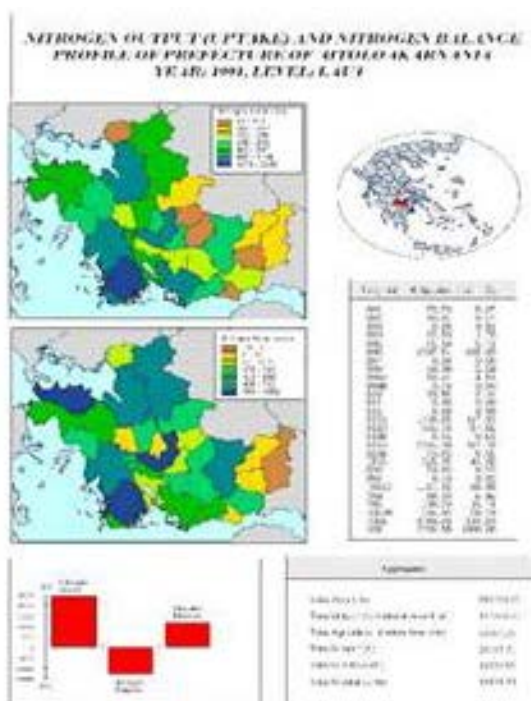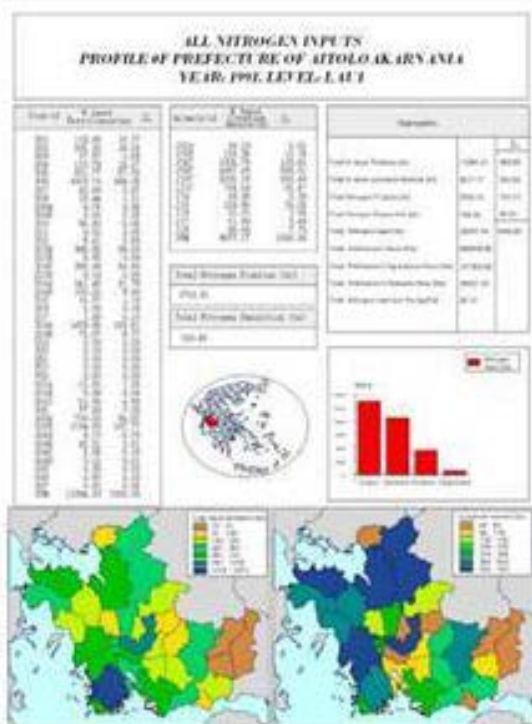

Figure 2. An example of nitrogen input and uptake at the municipal scale in Greece.

3. Results

Nitrogen input due to the consumption of mineral fertilizers is estimated at municipal level using the cultivated areas obtained from the FSS and relevant coefficients of nitrogen inputs from chemical fertilizers. (Figure 3). To estimate the nitrogen input the technical coefficients provided by Eurostat and

referred to the 1997standard year have been applied. According to the above estimation about 32% of nitrogen fertilizers are used in winter cereals, 16% in maize, 14% in cotton and 17% in olive trees. Nitrogen input due to livestock manure is calculated as a function of the number of animals present at the reference day of the FSS at municipal 1 level and the appropriate coefficients of nitrogen inputs from livestock manure (Figure 4).
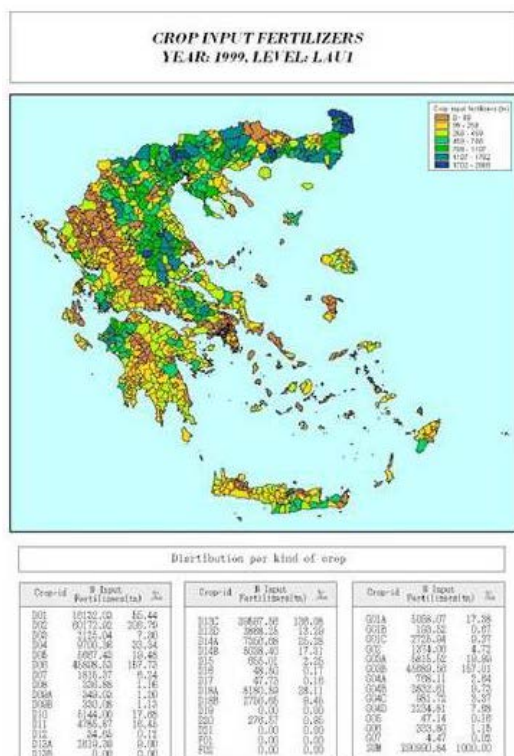
Figure 3. Distribution for kind of crop input fertilizers

According to the above estimation about 44% of the estimated nitrogen charge from manure is due to sheep breeding, 25% to goat breeding and the rest to other categories of animals. It is worth to notice that animal husbandry is of small size in Greece in comparison with other European countries and equally limited are the problems of pollution that it generates. According to the existing National Legislation livestock effluents cannot be applied directly to the land without wastewater treatment. The problem of pollution from this category of pollutants is geographically localized in certain regions of the country where there is concentration of livestock farms of middle or large size. These regions are: Prefecture of Evia (mainly around Artaki and Chalkida), Prefecture of Attiki (mainly in the areas of Megara, Aspropyrgos and Messogia), Prefecture of Thessaloniki (Neochoroutha, Pentalofos), Prefecture of Korinthia, Prefecture of Ioannina (around the lake

Pamvotitha), Prefecture of Arta and Preveza (in the watersheds of the rivers Louros and Arachthos), Prefecture of Larissa, Prefecture of Aitoloakarnania (around the lake Trichonis).
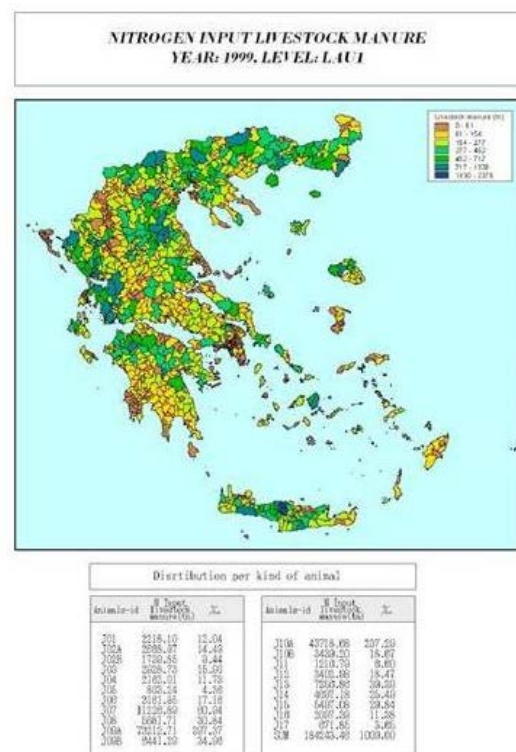

Figure 4. Distribution for kind of animal nitrogen input livestock manure.

Fixation by leguminous crops and clover was estimated using data on cultivated areas as they were collected though the annual agricultural survey that contains more analytical data level and a relevant fixation rate by kind of crop. Data were aggregated at municipal level for all categories of leguminous crops. The total quantity of nitrogen fixation from legumes was estimated at 35,704 tons (Figure 5).

Nitrogen deposition to agricultural land was estimated using data on the utilized agricultural area from the FSS multiplied by a standard coefficient (7 Kg/ha). The outcome is that the estimated total quantity of nitrogen deposition in the utilized agricultural area amounts to 25,082. tons.

The nitrogen absorption from harvested crops (output) is estimated using data of the volume of the production by kind of crop level from Annual Agricultural Statistical Survey and the appropriate coefficients of Nitrogen content of the harvest crops for each kind of crop. From the above data it appears that the bigger absorption is due to the grazing pastures and, in a descending order, to tree crops, cotton, winter cereals and maize. The estimation of

the nitrogen absorption from areas under grass was based on the areas classified as pastures for animal grazing in CLC map.

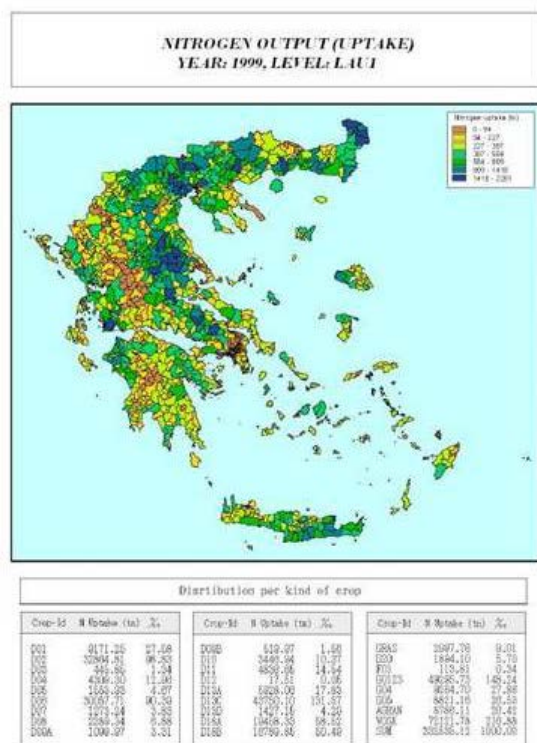An example for the reference year 1999 is presented in table 1 and Figure 6.

Figure 5. Distribution for kind of crop nitrogen output

Table 1. Nitrogen balance estimations for Greece in 1999

	Tons N
From crops	290,990.84
From animals	184,243.46
Atmospheric deposition	25,082.30
Biological process of legumes	35, 704.22
Total input	535,997.72
Total output	332,535.12
Balance	203,462.60
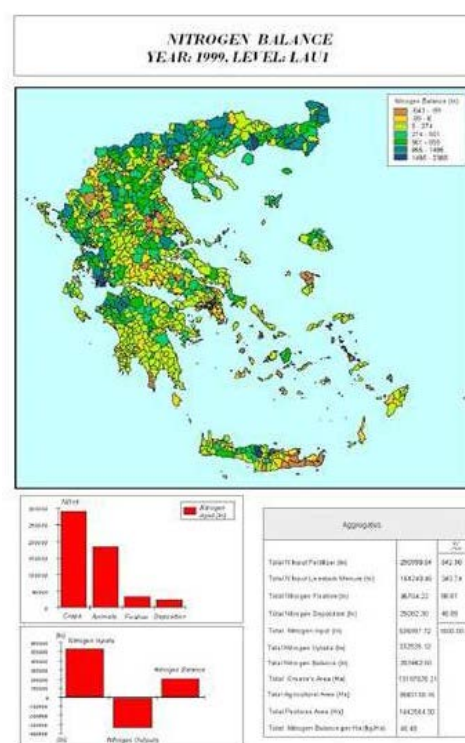
Figure 6. Nitrogen balance **.**

4. Discussion and Conclusion

Similar studies have been made in the past by Terres et. al. (2001) and by Hansen (2000). The first work refers to the EU countries at the prefectural in applying technical coefficients of EUROSTAT. and using data of the Farm Structure Surveys for the years 1990, 1993, 1995, and 1997. According to our point of view the non-adjustment of the technical coefficients by this work has a serious effect on the conclusions concerning the changes in nitrogenous fertilizers use through time. The best approach to this problem is to find an objective procedure for the adjustment of technical coefficients.

The method of adjustment used by Hansen (2000), which is adopted the present study refers to the adjustment of technical coefficients concerning the use of nitrogenous fertilizers according to the changes through time of their total consumption.

Hansen (2000), estimated the nitrogen balance at the prefectural level for the entire European Union. The aggregated results of the above-mentioned works for Greece are presented in Tables 2 and in Table 3:

Table 2. Nitrogen balance for Greece, 1997
according to Hansen (2000)

	Kg/ha	Tons of N
Total agricultural land 3486 th. Ha		
Nitrogenous fertilizers for crops	88	306768
Organic fertilizers (manure)	49	170814
Nitrogen fixation	2	6972
Atmospheric deposition on agricultural	7	24402
Total (input)	146	508956
Nitrogen absorption from crops (F(q))	29	101094
Nitrogen absorption from	69	240534
Nitrogen balance	48	167328

Table 3. Nitrogen balance estimates for Greece,
1991 according Terresa ect al. (2001)

	Kg/ha	Tons of N
Total agricultural land 3486 th. Ha		
Nitrogenous fertilizers for crops	76.94	250703
Organic fertilizers (manure)	12.84	41850
Nitrogen fixation from leguminous crops	-	-
Atmospheric deposition on agricultural land	18.33	59723
Total deposition (input)	-	352276
Nitrogen absorption from crops (F(q))	60.66	197647
Nitrogen balance	47.46	154629

The previously mentioned works are based on the following assumptions:

1. For the estimation of the nitrogenous fertilizers consumption, sampling data about the land area and the number of animals are used, originating from the Farm structure surveys. As a result of the above process, sampling errors are involved in all estimations;

2. Terres etc al. (2001) used constant technical coefficients for the quantities of fertilizers for all years and crop. This treatment ignores changes in farming practices as these are profoundly reflected in the overall consumption of fertilizers;

3. For the quantity of nitrogen absorption from grasslands and pastures, indirect calculations based on animal needs in grass (harvested or not) were used;

4. The nitrogen fixation is underestimated in the case of legumes as many of them, mainly those used for feeding animals are not presented as a separate category in the Farm Structure Survey;

5. Both studies deal with the establishment of nitrogen balance at prefectural level.

The present study uses agricultural census data in order to avoid problems due to sampling errors of the farm structure survey. Also, the technical coefficients provided by EUROSTAT for reference year 1997 are adjusted in the case of the nitrogen fertilizers usage for the years 1991 and 1999, in accordance with their total consumption in the reference years.

The need for more accurate estimation of the quantity of grass was satisfied, because the Annual Agricultural survey includes analytical reference to all relevant crops producing fodder plants for grazing within the utilized agricultural area, which is the object of the research. The same files give detailed data for all kinds of legumes and, as a result, the estimation related to nitrogen fixation in the soil is more accurate.

The estimation of forage produced outside the agricultural land was performed in the present work by using the special survey of National Statistical Service of Greece (NSSG), referring to 16 agricultural land uses. The areas under pastures before deriving from this source are estimated to be about 1.4 million hectares. We assume that this area is used for the grazing of animals.

Comparing to the above mentioned work, it could be concluded that the present results are closer to Hansen's approach. For instance, Nitrogenous fertilizers for crops counts 306,768 tones of Nitrogen in Hansen's work, which is very close to the value in the present study (290,990 tons). Balance of N is

estimated equal to 203,463 tons in the present study, value that is closer to Hansen's one (107,328 tons).

The advanced methodology applied in the present study provides accurate estimations of Nitrogen balance. Additional work will be done to extent the estimations and to improve the methodology. Interesting results are extracted for the vulnerable areas of Greece to soil pollution by pollutants category. As a concluding remark, it could be stressed out that a powerful and informative tool a nitrogen believe at municipal land can permanently support in agro-environmental policies at the regional scale in the Mediterranea basin.

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Corruption Investigated in the Lab:
A Survey of the Experimental Literature

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Abstract - **The article provides a survey of the growing experimental literature on the investigation of corruption and extends previous surveys. Furthermore, we discuss three aspects which deserve more attention in further research. These are, first, a more careful consideration of individual norms, second, a broader perspective on the influence of norms within groups on corrupt behaviour, and, third, embedding corruption experiments in more extended social science research on corruption.**

Keywords *- bribery; corruption experiments; economic experiments*

1. Introduction

Economists and other social scientists have shown a long and ongoing research interest in corruption (cf. Rose-Ackerman 2006). For instance, they investigate the relation between governance structure (Kaufmann et al. 2007, Shah 2006), hierarchy (Mishra 2006), political decentralization (Fan et al. 2009), culture (Lipset and Lenz 2000), or individual characteristics (Mocan 2008; Olken 2009) and the emergence of corruption. They analyze different forms of corruption, such as bribery, embezzlement in private and public organizations, and rent-seeking behaviour in general. Many studies in economics and other social sciences are motivated by an interest in the effects of corrupt activities on efficiency and development, hence the effects on the well-being of groups.

In the economic analysis of corrupt behaviour institutions play a central role (see Serra 2006 for a test of variables related to corruption). Corruption itself is an institution in the sense that it can constitute a behavioural norm for members of a group. If individuals implement these norms into their decisions, the outcome may be an inefficient equilibrium. Moreover, corruption is an institution because it is an allocation mechanism which occurs in addition to, or replaces, other existing allocation mechanisms, such as markets or hierarchies. Individuals rely on the 'institution of corruption' if the expected gains from corruption are higher than the expected gains when using alternative institutions. In this sense, individuals substitute or complement different institutions by employing corruption in order to achieve individual aims. Since expected gains also depend on expected costs, corrupt behaviour may rise since the expected costs of using the institution of corruption are lower with respect to achieving the individual aims compared to those of alternative institutions. Consequently, understanding individual behaviour with respect to corruption requires a consideration of institutions.

Within the New Institutional Economics framework 'corrupt behaviour' is often defined as rational behaviour in a principal-agent model (cf. Lambsdorff 2002). If agents are corrupt, they optimize under given constraints and misuse their power for a private benefit (Lambsdorff 2007, 16). Thus, negative externalities for third parties can occur. Corruption is in many contexts regarded as a form of criminal activity. If economists follow this perspective, it is because corruption may lead to inefficiencies and consequently to a loss of social welfare.

A milestone in the economic literature on behaviour and crime is Becker's paper (1968). Becker applies rational choice theory to criminal activities and outlines the influence of fines on such behaviour. Becker's ideas have been applied to corruption of law enforcers such as the police (Becker and Stigler 1974). If the aim is to reduce corruption, then different incentive mechanisms which influence opportunity costs become important. One proposed solution is to increase salaries of law

enforcers in order to increase the quality of their work and to make them less vulnerable to attempts of bribery and, with this to increase the opportunity costs of losing their job. A second solution is to implement competition among law enforcers and to allow private law-enforcing agents to operate beside state agents. Another approach is to implement a controlling agent (e.g., an anti-corruption unit) who monitors the law enforcement agency. If an anti-corruption unit is permitted to collect fines from corrupt law enforcement agents (cf. Mookherjee and Png 1995; recently Silva et al. 2007), this may reduce corrupt behaviour (cf. for casual corruption also Bowles and Garoupa 1997; Chang et al. 2000). In short, the institutional structure in which corruption is embedded influences the emergence and the level of corrupt behaviour (cf. e.g., Shleifer and Vishny 1993).

However, additionally to theoretical studies it is necessary to consider empirical microeconomic studies because their results provide a further analysis of the mechanisms underlying corruption. Moreover, empirical research allows testing variables that influence corrupt behaviour and may thus give advice for political measures aiming to reduce corruption in a society. Among other methods, economic experiments are one possibility for empirical investigation (cf. Dušek et al. 2005; Abbink 2006). Economic experiments can be considered a complementary method to those methods employed in related social sciences in order to investigate corruption, such as questionnaire surveys in Sociology or participant observation and case studies in Anthropology and Criminology: experiments allow controlled tests on the influence of specific variables on corrupt decisions. Thus, experiments are empirical tests of the formulated theories and, furthermore, results from experiments may allow formulating policy measures to fight corruption.

Testing corruption empirically through economic experiments is, however, a rather new field. Some years ago Renner (2004), Andvig (2005), Dušek et al. (2005), and Abbink (2006) published first surveys on the topic. A more recent survey of Frank et al. (2011) focuses on the aspect of gender and corruption in economic experiments and Li (2012, 22-54) analyzes the influence of culture. In this paper we summarize and expand the surveys by showing recent trends in this emerging literature and outlining three aspects, which deserve a more thorough investigation in future research. First, we argue that individual's values and perceptions in experiments should be

considered more carefully. Second, a broader perspective is needed to investigate the influence of groups and group norms, such as networks, on corrupt behaviour. While research on group behaviour and effects of individual behaviour on group members is a standard topic in experimental economics, the transfer to the research on corruption has not been exploited yet. Third, we emphasize that economic corruption experiments need to be embedded in broader social science research on corruption. These three aspects are outlined in the third section of the paper after the survey of the recent experimental literature in the next section.[1]

2. Corruption Investigated in the Lab

In the surveys of corruption experiments by Andvig (2005), and particularly by Dušek et al. (2005) and Abbink (2006), several economic experiments on corruption are discussed in detail.[2] That is why we keep the discussion of those papers that are already discussed comparatively short and concentrate on newly emerging strands in the literature. We proceed mainly chronological, with particular focus on the emergence of different classes of experiments.

Two experiments on factors that influence corruptibility of individuals are conducted by Frank and Schulze (2000) and Schulze and Frank (2003). Frank and Schulze (2000) carry out the first economic corruption experiment ever recorded. They implement two different treatments: in a controlled environment without any risk of detection, individuals have first to decide in a situation with a trade-off between maximizing individual profit and maximizing the gains of the public interest. In the

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[1] Since some studies have been reviewed while being working papers, the years of publication of the studies mentioned here may differ from those in previous surveys. The literature has been developing very fast and only in 2011 a large number of working papers emerged. We are aware that this survey cannot capture all available papers. We have tried to cover all papers published by mid 2011.

[2] For instance, the papers of Frank and Schulze (2000) and Schulze and Frank (2003) are reviewed in Andvig (2005, 255), Dušek et al. (2005, 152-153), Abbink (2006, 420-422), and Frank et al. (2011). The same applies for the papers of Abbink (2002) and Abbink et al. (2002) which are elaborated on in Andvig (2005, 265), Dušek et al. (2005, 150-152), or Abbink (2006, 422-424), and the paper of Azfar and Nelson (2007) is reviewed in Andvig (2005, 266), Dušek et al. (2005, 154-155), and Abbink (2006, 429-431). Frank et al. (2011) summarizes, for instance, Rivas (2008), Alatas et al. (2009a), Armantier and Boly (2008), and Abbink (2006, 434-435) summarizes Büchner et al. (2008). Nevertheless, several other published papers have not been considered in previous reviews.

second treatment, in addition to individual pay-off from the experiment, participants receive an additional lump-sum payment in order to examine whether corruption would decrease if individuals are rewarded for their 'job' during the experiment. Frank and Schulze (2000) find out that, apparently due to self-selection, economics students tend more to corruptibility than other groups of students, and that lump-sum payments do not affect the outcome. In their second experiment, Schulze and Frank (2003) test the impact that a detection mechanism has on the propensity for corrupt behaviour. In an experiment with a similar setting like the experiment of Frank and Schulze (2000), they introduce a detection likelihood that positively depends on the amount of the bribe proposition. If a corrupt individual is detected, she does not receive a positive pay-off. The aim is to investigate whether the possibility of detection lowers corruption or strengthens it due to the increased costs of corruption. In this experiment, only one player receives her pay-off in the end. Schulze and Frank's findings indicate that a detection mechanism significantly increases the amount of people deciding for a corrupt action, thus it abates the intrinsic motivation for honesty. However, in their experimental setting there were fewer people under monitoring who engage in corruption.[3]

One of the main objectives of experiments on corruption is the investigation of a bribing situation. In many cases experiments are designed in such a way that a public official takes a bribe from an individual in exchange for a favour (Abbink 2006, 422). These experiments address reciprocity and are often investigated in the form of a modified trust-game.

Abbink et al. (2002) are the first who design a bribery experiment with regards to the influence of punishment and negative external effects. Abbink et al. (2002) have a lasting effect on the literature and their experiment has been replicated and adopted in many ways. The original experiment consists of three treatments with the pairing of two players, one in the role of a firm and the other in the role of a public official. The firm decides if she wants to propose a bribe to the public official and has to pay a relatively low transfer fee. If the public official rejects the

bribe, both players receive their initial endowment, less the transfer fee. If the public official accepts, both payoffs increase significantly. In the second stage of the game, the public official decides between two options: one option significantly increases the pay-off of the firm but has a lower pay-off for the public official. The other option is better for the public official but has a negative effect on the pay-off of other players. The major findings of this investigation are that the introduction of a negative external effect in the form of a reduced payoff of other players does not seem to significantly affect the amount and frequency of bribing. On the other hand, after the introduction of a punishment mechanism the average bribing amount as well as the frequency in the choice of the option, which is better for the public official, significantly declines.

In follow-up studies, Abbink (2002, 2004) investigates the effects of fair salaries and the impact of staff rotation on corruption in Germany. The experimental layout is built upon the experimental design of Abbink et al. (2002). Results of the first game with staff rotation (Abbink 2004) reveal a sharp decrease in the average bribe as well as in the frequency of the choice that favours the public official. In the second game with differences in salaries (Abbink 2002), no significant difference was captured between the high-wage and low-wage treatment, so the salary seems to have no influence on corruptibility in this case. Some of the studies which also use the set-up of Abbink et al. (2002) are discussed next.[4]

Abbink and Hennig-Schmidt (2006) run a corruption experiment that investigates the effect of in-context framed presentation of the experiment on the level of corruption compared to an abstract neutral terminology, as typically used in experimental economics (Abbink and Hennig-Schmidt 2006, 103-104). They address the question of external validity of corruption experiments, a problem also mentioned by Dušek et al. (2005). Since the term 'corruption' usually has a negative connotation, Abbink and Hennig-Schmidt investigate whether a neutrally framed corruption experiment with abstract wording is capable of catching the real-life reaction of participants adequately. Their experimental design is built on one of the treatments of the bribery trust-game introduced by Abbink et al. (2002), but with

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[3] Olken (2007) reports about a field experiment in Indonesia. He finds that an increase in audits of road projects in villages have a positive effect on reduced missing expenditures and concludes "… that traditional top-down monitoring can play an important role in reducing corruption, even in a highly corrupt environment." (2007, 201).

[4] The working papers of Jacquemet (2005) and Castro (2006), both using the design of Abbink et al. (2002), are not discussed here, but see Abbink (2006, 427-428) for a discussion of Jacquemet.

different instructions in one of the two treatments. They compare the results of the neutrally framed game with the same game with framed instructions in order to provoke a framing effect by suggestive phrasing. The task is presented as an interaction between a firm and a public official, where the firm can engage in private payments in order to receive a permission for an industrial plant and with this, harm the public. Abbink and Hennig-Schmidt (2006) also implement a punishment mechanism in the form of an immediate exclusion from the experiment with the likelihood of 0.3%. In contrast to the hypothesis that framed instructions will provoke a negative attitude towards corruption and thus, lead to less corrupt behaviour, there is no significant treatment effect through framing: neither the average bribe proposed by the firms, nor the frequency of permissions given by the public officials differs between the treatments. As Abbink and Hennig-Schmidt conclude, for this specific experiment, presenting this experiment with suggestive wording does not alter the findings.

Rivas (2008), also following Abbink et al. (2002), investigates gender effects (cf. also the discussion of Rivas 2008 in Frank et al. 2011, 62-63). In the experiment four sessions are conducted in order to find out whether the behaviour of the participants depends on the gender of their opponents. In two of the sessions subjects of both genders participate: one gender in the role of the firm, and the other gender as the public official. In the other two sessions only subjects belonging to one gender participate in both roles. The result is that gender has no statistically significant effect on the probability of offering a bribe, although the bribe amount is lower if the briber is a woman. Women tend to accept bribes less frequently if the briber is a woman. After accepting a bribe, women in the role of public officials tend to engage in a reciprocal action less frequently than men. Rivas concludes that men are more corrupt than women and that a greater number of women in positions where corruption occurs could lower the level of corruption.

González et al. (2007) conduct a bribery experiment that is based on an ultimatum bargaining game (González et al. are also discussed in Abbink 2006, 426-427). González et al. investigate the effect of greasing a public official in order to reach a faster decision. The experiment is a one-shot game and uses a strategy elicitation method. In the experiment, a player in the role of a firm can portion an amount of money in three parts among herself and two other players in the role of two public officials. This

reflects a situation in which a firm applies for a permit that has to be approved by two public officials. This permit will allow the firm to gain a certain surplus, which she can divide between her and the two public officials. Both public officials, independently of each other, have to accept this proposal in order for the payment to take place, thus, both public officials have veto power. Only one of the two public officials has the power to prolongate the decision, which is costly for the firm and also costly for herself. This public official has full information about the offer of the firm: she knows her proposed amount, the amount proposed to the second public official and the amount that the firm keeps for herself. The other public official, who has no power to delay the decision, has only the information of her own amount proposed by the firm. The effect of bribery is captured here through the additional amount which the firm proposes to the public official who has the power to prolongate the decision, not generally through the amount proposed to the two officials.

The findings are as follows: the public officials who have the power to delay their decision often demand a premium. The public official with delay power tends to use this power when the other public official receives a higher amount than herself. The amounts offered to the public officials by the firm are higher than one would expect according to traditional theory. The firm offers this 'premium' in order to avoid a delay, it thus engages in greasing. Proposals that implement an equal amount for each involved player lead to the highest acceptance rate. Both public officials reject very low offers, underlying the importance of social norms in strategic games.

Bilotkach (2006) tests bribery in the context of tax evasion with a comparatively small number of subjects. In the experiment students are in the role of businesspeople who can avoid being taxed through bribing an official. The experiment resembles a conspiracy situation between tax payers and public officials and is adapted to the situation in Ukraine. Bilotkach finds that participants in the role of businesspeople offer bribes more aggressively if they know about the corruptability of participants in the role of public officials (2006, 31). However, offering bribes has no effect on the behaviour of the participants in the role of public officials.

Armantier and Boly (2008) investigate the external validity of a laboratory experiment with students from Canada against a field survey in Burkina Faso (the paper is also briefly reviewed in

Frank et al. 2011, 64). One subgroup of the players has to write a dictation, and their payoff is negatively correlated to the flaws they make in their writing. They have the option to bribe the other subgroup of players who correct the dictation and could overlook flaws in reward for a bribe. In the conducted experiment, each agent bribed her corrector. In four different treatments the authors investigate the variation effects of the payment amount, the amount of the bribe, and the monitoring and punishment for bribing. The findings of Armantier and Boly reveal that results of the laboratory experiment as compared to results of the field experiment show statistically insignificant differences. With respect to individual characteristics they find that religiosity and age seem to be negatively correlated to the acceptance of bribes.

Another recent experiment investigates cultural differences. Cameron et al. (2009) conduct a corruption experiment in Australia, India, Indonesia and Singapore in order to test the impact of culture and institutional framework within a country on individual decision making. While according to Transparency International's Corruption Perception Index (CPI) Australia and Singapore are among the least corrupt countries in the world, the opposite counts for Indonesia and India. Cameron et al. test whether a corrupt environment, on the one hand, promotes corruption since it lowers the inhibition threshold and, on the other hand, generates tolerance and thus lowers the propensity to punish corrupt behaviour. In the experiment a player in the role of a firm can offer a bribe (for little costs) to a player in the role of a public official. The public official can accept or reject this proposition. If the public official accepts the bribe offer of the firm, then the payoff of a third player, the citizen, decreases, while the payoff of both the firm and the public official increases through bribing. The citizen can punish the other two players in the last stage of the game. If she decides to punish, she reduces her own income. Two different treatments are played: one is welfare-reducing, the other is welfare-enhancing in the case of corrupt decisions. In the welfare-enhancing treatment the sum of the payoffs of all players is higher if bribing occurs because the losses of the third player are lower than the combined gains of the other two players.

In line with theoretical predictions, in most of the games a bribe is offered and the public officials also accept the bribe in most of the cases. However, approximately half of the citizens whose payoff decreases through bribing, decide to make use of

their punishment opportunity. Cameron et al. find a significant cross-country difference in the participants' behaviour: Indians, as compared to Australians, being confronted with corruption, have a lower punishment frequency, while their propensity to engage in corruption is higher. Contrary to these findings, participants from Indonesia who are confronted with a high level of corruption in their country, have little tolerance for corruption. As for Singapore with a low level of corruption, the participants from this country are highly inclined to engage in corruption, and also disinclined to punish corruption. Cameron et al. argue that a more detailed institutional and historical framework of corruption in the countries has a considerable impact on individual behaviour, and due to that, the CPI is not able to capture all relevant factors in order to explain the variation of behaviour across the four countries. This emphasizes the impact of institutions like laws and group norms on individual behaviour with regards to corruption, which we discuss in the third section.

Alatas et al. (2009b) conduct another field experiment with regard to subject pool effects. Participants are on the one hand Indonesian students and on the other hand Indonesian public servants. As corruption in Indonesia is comparatively high, they expect public officials to be more exposed to and, thus, more experienced with corruption than Indonesian students (this hypothesis was also confirmed through a post-experimental questionnaire about corruption contact at work, but not outside the working place). The corruption experiment is built on the experimental design of Cameron et al. (2009), but does not explore cross-country differences of student behaviour but the inner-country differences among different subject pools instead. In contrast to most other corruption experiments, Alatas et al. (2009b) frame their experiment in the form of loaded instructions and use the terms 'bribe' and 'punishment' (Alatas et al. 2009b, 117). In this way, they first test for an experience effect with corruption. Second, they test for a selection effect whether people with a specific attitude towards corruption are inclined to become public officials. The game is a one-shot game and three participants are included in a single round: one has the role of a firm who can bribe the public official in order to boost her payoff; the other participant is a public official who can accept or deny the proposal of the firm; the third player has the role of a citizen who is harmed by a bribing action between the two former participants. This citizen can punish the other two players by decreasing their income after bribing has taken place. Through

punishment she diminishes her own payoff as well. Engaging in or abstaining from punishment also shows her tolerance level for corruption. Results show that students in the role of a firm are more likely to engage in bribing than public servants in the role of the firm. Furthermore, students in the role of a public official are also more likely to accept a bribe than public servants in the same role. No significant difference in tolerance for corruption through punishment frequency is captured between the two subject pools. No self-selection effect is found in the experiment: the behaviour of students who indicate that they plan to become a public servant, is not statistically different from the behaviour of the other students, but is statistically different from the behaviour of public servants. Alatas et al. (2009b: 125) conclude that this underlines the impact of real-life work experience on behaviour. The experience effect expresses itself in the low tolerance for corruption of participants who are often confronted with corruption at work.

A new strand of experiments has been developed by Barr and Serra (2009) who employ a modified one-shot ultimatum game, and analyze the impact of framing and variations of external costs. They find that bribe acceptance is comparatively low if negative externalities are comparatively high, hence individuals tend to abstain from corrupt behaviour if the external costs are heightened. However, the effect may be due to inequity aversion of players. A different framing does not lead to a significant difference in bribe acceptance in their experiment. Based on the experimental design of Barr and Serra (2009), Barr and Serra (2010) conduct two corruption experiments (in 2005 and 2007) in order to test the cultural impact on the propensity for corruption. The first experiment in 2005 is conducted with a group of 195 students from Oxford. One third of them are British, the other participants come from 33 different countries which Transparency International rates differently regarding corruption. The experimental design is as follows: 15 participants play in five groups of three players each. One participant in the role of a citizen proposes a bribe to a participant in the role of an official. If the player in the role of the official accepts (this is captured through the strategy elicitation method), the payoff of both players increases. Simultaneously, the payoff of the third players in the role of a member of the society in each of the five groups diminishes (Barr and Serra 2010: 864). Barr and Serra's findings indicate that undergraduate students coming from countries with a comparatively high corruption index are also more

inclined to engage in a 'corrupt' action in this experiment. However, these results do not hold for graduate students. Barr and Serra comment that the time spent in the immigration country and the selection process of the different immigration procedures may have distorted their subject pool and, thus, lead to different results for undergraduates and graduates.

In 2007 Barr and Serra conduct another slightly different experiment (Barr and Serra 2010) in which they try to reduce the inaccuracy of their explaining variables. Here, the official indicates her bribing request, and the citizen indicates whether she accepts to pay the amount (the behaviour of the citizen is captured through strategy elicitation). This approach is reverse to the experiment in 2005, but all the other parameters of the 2005 game remain unchanged. Again, one third of the students are from Britain, and the other participants come from 21 different countries. In this experiment, as in 2005, undergraduates coming from a country with a comparatively higher rate of corruption (according to Transparency International) show also a higher propensity to engage in corruption than undergraduates coming from countries with a comparatively lower rate of corruption. Again, this result does not hold for graduates. A deeper analysis of the impact of the time spent in the immigration country reveals that the propensity to engage in corruption decreases over time spent in Britain. However, this cannot explain the variations between undergraduate and graduate behaviour. Barr and Serra try to capture a selection effect of students coming to Britain by asking these students whether they are financed by a fellowship or their families. The hypothesis is that families who are financing their children's education from their home country are richer, and thus, more corrupt, which may have an impact on the student behaviour. Barr and Serra find no confirmation of this hypothesis. They conclude that cultural socialization and norms can influence corruption.

In another recent study Serra (2011) tests the effectiveness of different monitoring mechanisms. One monitoring approach is top-down monitoring. The intervention against corrupt behaviour is conducted by the state, i.e. one public official controls another public official. An alternative monitoring approach is bottom-up monitoring where auditing is performed by citizens who are affected by corrupt relationships and, thus, have more information. The experiment of Serra (2011) is a one-

shot game and builds on Barr and Serra (2009). It is conducted with 15 participants per round with 5 participants in each role. A player in the role of a citizen requires a service from the official. A player in the role of an official can demand a bribe from the citizen for a higher quality or for a faster processing of the service. If the citizen accepts to pay the bribe demanded by the public official, both players are better off. But if bribing is successful, then the payoff of the five other players in the role of the society diminishes. Serra (2011) investigates the propensity to demand bribes in three different treatments: first, a treatment without any form of monitoring, where the highest bribing frequency occurs; second, a treatment with top-down monitoring where the punishment likelihood for bribing is given as a percentage; third, a treatment with a combined mechanism, i.e. a bottom-up mechanism that enables top-down monitoring only after a complaint from a citizen. After a public official has demanded a bribe from a citizen, the citizen has the opportunity to report the public official without facing punishment costs herself. Only in cases where the public official is reported, she has to expect punishment with the same probability as in the second treatment. Otherwise the punishment probability is zero. Thus, the likelihood of being punished for a corrupt action in the third treatment is lower than in the second treatment with only top-down auditing. In contrast to the theoretical prediction, in this third treatment the bribing frequency is lower than in the second treatment although bribing in this third treatment is more rewarding for public officials. Surprisingly, the third treatment with the combined auditing mechanism and the lower probability of detection is the most effective mechanism to reduce corruption. Serra (2011:17) concludes that this result may have been obtained due to an aversion to betrayal by violating a subjective norm, and the non-monetary costs of a social disapproval in the form of being formally reported by a citizen. Serra also considers a behavioural bias, the conjunction fallacy in probability judgments, as an explanation for the experimental deviation from the theoretical prediction.

Drugov et al. (2011) investigate the role of agents as intermediaries in a corruption framework. Intermediaries facilitate the relationship between a briber and a bribee by lowering information costs, for instance the costs of whom to bribe and also negotiation costs of an agreement upon a bribing amount. An intermediary could also reduce the risk of being detected and punished and also lower the risk of a promise breach, as the intermediary is able to build up a long-term relationship to the bribee, which may be impossible for a briber (Drugov 2011, 3-4). Drugov et al. test whether intermediaries that facilitate the relationship between a briber and a bribee enhance the level of corruption: They expect that intermediaries may have the effect to abate the moral costs of a corrupt action, thus corrupt activities may increase (Drugov et al. 2011, 7). They use the experimental structure of Barr and Serra (2009). A player in the role of a citizen decides whether to bribe a public official in order to receive a certain service. The player in the role of a public official can accept or reject this proposition. If she accepts, her payoff and the payoff of the citizen increase, while the payoff of the third player diminishes. Drugov et al. conduct three treatments. In the first one, no intermediaries are involved. Here, citizens have no information about the bribing amount the public officials are likely to accept. In the second treatment, intermediaries are introduced as a fourth player. They communicate the minimum amount the public official would accept as a bribe to the citizens, who now have to decide whether to pay or not to pay this amount. In the third treatment, no intermediary is present, but the citizens are informed about the minimum bribing amount the public official is willing to accept. Findings suggest that intermediaries increase the share of corrupt public officials and the share of citizens who engage in corruption. In the presence of intermediaries, the moral costs of a corrupt action seem to diminish for the briber and bribee, as the average bribing amount demanded is lower and is paid more frequently by citizens.

Barr et al. (2009) use an experimental design previously introduced by Azfar and Nelson (2007). In the experiment of Barr et al. (2009) a typical principal-agent relation is constructed in which the agent provides a service to a third party. Information asymmetries exist and the principal engages a monitor who controls the agents but can behave opportunistically. The set-up resembles a situation in public service sectors with the principal being the government which employs civil servants to provide services for third parties: the service recipients. Barr et al. (2009) conduct the experiment with employees in the Ethiopian health sector. They find out (2009, 237) that if the service recipients elect the agents *ex ante*, they then provide better services. If monitors are elected, these show higher efforts in their monitoring activity. The positive effects of electing monitors have previously been analyzed by Azfar and Nelson (2007) as well. They also reveal that

increasing wages reduce corrupt behavior and that reducing the options to conceal gains derived from corrupt decisions has the same effect.

Lambsdorff and Frank (2010) test how the wording influences decisions in a corruption game. Proposers in an ultimatum game are in the role of a businessperson who can label her bribe as a 'bribe' or as a 'gift'. Receivers play the role of public servants who can reciprocate, whistle-blow, or behave opportunistically. Results show that those businesspeople who prefer to call their bribe a 'bribe' are willing to punish opportunistic behavior of public servants harder than those businesspeople who label their bribe a 'gift'. Their interpretation is that the term bribe is consciously chosen by proposers since the word indicates an expectation for reciprocity on the part of the civil servant (2010: 354). If the bribe is labeled as 'gift', the expectations of the bribe giver are signaled less clear. The wording itself becomes a signal for an individual's expectation of other people's behavior and thus, an enforcement mechanism of corruption. Schikora (2010, 2011) has investigated the effects of whistle-blowing on corruption more specifically. He finds that in a situation where both parties, a client and a public official, have the option to initiate corrupt behavior and where both have the option of whistle-blowing, then corruption increases rather than decreases (cf. also Lambsdorff and Frank 2010). A possible interpretation is that the option of whistle-blowing stabilizes reciprocal behavior.

In an early survey of Dušek et al. (2005: 155) another line of experiments is addressed. Dušek et al. refer to an experiment of Falk and Fischbacher (2002) in which participants have the option to maximize their own utility at the expense of others. The authors find out that "the average subjects steal the more, the more others steal." (Falk and Fischbacher 2002, 859). The neutrally framed experiment does not address corruption as such, however the results are relevant for situations in which corruption can occur. If social interaction effects within groups emerge, then corruption may be a self-enforcing institution within groups (cf. additionally Goette et al. 2006 for the effects of group membership on norm enforcement, and also Funk 2005; Dong et al. 2008 introduce the term 'conditional corruption'). Thus, information about others' behaviour may influence individual decisions whether to engage in corrupt behaviour or not. This line of experimental studies has not found much

attention in experimental investigations on corruption yet.

One recent exception is Schikora (2010, 36-76) who addresses in his study the relationship between corruption and cooperation. He conducts three experiments: First, he tests the Four Eyes Principle in the Lab. Although this mechanism is often claimed to diminish corruption, Schikora finds that introducing this principle in an experiment has ambiguous effects and can increase corruption. Second, he analyzes the effect of a whistle-blowing option on corruption. Whistle-blowing had two effects: It stabilized a corrupt relationship, and it serves as an insurance against exploitation by a public official. In his third experiment, Schikora analyzes the relationship between cooperation in a modified public good game and group composition. His findings of the differences in cooperation with regards to different groups stress the importance of within-group dynamics for the behaviour of individuals.

3. Outlook

In this concluding section we discuss aspects that, according to our opinion, deserve more careful consideration in future experiments on corruption. We fully confirm Abbink's (2006, 435) statement on corruption that "[g]iven the vastness of the phenomenon and the plethora of situations in which it occurs, a dozen papers can barely scratch the surfaces." Nevertheless, the literature is growing rapidly and more corruption experiments have been recently conducted but have not been published yet. In 2006 Abbink provided an outlook on three issues, which he thought to be important for further experimental research: the discussion on using neutral or loaded instructions, the influence of culture, and the link between field and laboratory research on corruption. To a certain degree the literature published over the last years has considered some of these issues, for instance, Barr and Serra (2009), Lambsdorff and Frank (2010) on framing effects, or Barr and Serra (2010) and Li (2012) on cultural differences. Our analysis refers to these issues but considers them in a broader context. Particularly, we suggest for the future a more careful consideration (1) of individual values in corruption experiments, (2) a broader perspective on the influence and emergence of norms within groups on corrupt behaviour, and (3) embedding corruption experiments in the much broader social science research on corruption. Next, we outline these issues

and refer, where necessary, to further papers which point in the respective direction.

(1) Individual values: The answer to the question *which* specific behaviour can or cannot be considered as corruption is complex. Laws label certain actions as corrupt in the sense that they are illegal. Implementing such an exogenous definition into an economic experiment unambiguously for all participants is challenging: Whether an individual perceives her actions as corrupt may considerably differ from the law and strongly depend on the environment of the experiment. Furthermore, if an individual in an experiment chooses an action framed with the words 'corrupt', it does not necessarily mean that she considers herself corrupt after picking that move. In fact, no legal consequences follow, and any punishment mechanism in the form of social pressure after detection normally ends with the experiment. The only similarity to actual corruption consequences in an experiment is the participants' associations with the wording. A participant could engage in a 'corrupt' action only due to utility maximizing or reciprocity without considering herself in violation of any norms or legal framework. Abbink (2006, 435-436; cf. also Abbink and Hennig-Schmidt 2006) refers to the problem when he addresses the issue of wording experimental instructions, i.e. using loaded versus neutral wording. He emphasizes the specific, morally loaded context of corruption.

We believe that the basic reason of the problem is the reference to an exogenously set definition, i.e. the definition of an experimenter who defines corrupt and non-corrupt behaviour in a specific experimental context. Specific terms may be, due to individually different moral values, of importance for some but not for other participants in a group of participants. If we assume that individual perceptions of corrupt behaviour are different within groups of participants in an experiment, then the same decisions may not be interpreted in the same way for all individuals. Decisions that have been considered as an indication for corruption, then, may in fact be interpreted rather differently. We know from empirical studies that a correlation between demographic variables, such as gender or age, and corruption exists (cf. Gatti et al. 2003; for gender Frank et al. 2011) and that tolerance levels of corruption differ between sub-groups of a population (see Alatas et al. 2009b for Indonesian students vs. Indonesian public servants). Hence, testing the impact of variables on corrupt behaviour requires additional knowledge on whether participants themselves consider their behaviour as

corrupt. The subjective perception of and attitude towards corruption is important, if policy measures are derived from experiments to fight corruption. Nevertheless, most of the economic experiments on corruption have not systematically tested whether individuals violate their subjective values if they decide for a corrupt action. The only exception is, to the best of our knowledge, a working paper of Campos-Ortiz (2011) who reports on an experiment in this direction. He let participants report on their previous experience with bribery and on their individual attitude towards it. He finds out that those participants who have shown a propensity to corruption and a higher willingness to pay bribes in the past show a stronger pro-bribery behavior in his experiment. Despite a possible measurement bias which may emerge in ex ante- or post-experimental interviews this result is challenging for developing policy measures to fight corruption.

(2) Intra-group Norms: Some experiments address the relation between culture and corruption.[5] One assumption of these studies is that moral values are different between members of different groups and that these can be measured with variables such as nationality (Cameron et al. 2009). The hypothesis reads that such differences in behaviour could be due to dissimilar social norms prevalent in different groups, hence cultures. Experimental results show (Cameron et al. 2009) that differences in behaviour can be related to cultural variables even if participants decide under the same legal framework (cf. Barr and Serra 2010). While culture is an important aspect to be investigated in more detail, we argue that it is insufficient to control for group characteristics, such as nationality, ethnicity or religion. Additionally, processes *within groups* need a more careful consideration.

The experimental starting point could be Falk and Fischbacher's (2002) results that social interaction effects are relevant, as already discussed in Dušek et al. (2005, 155). Economic experiments on corruption have not addressed the influence of group members on other members in detail yet. In many cases when corruption occurs, the principal–agent situation is rather complex because principles, agents and also monitors are members of specific or

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[5] In the experimental context the term 'culture' is often applied to participants with different nationality, ethnicity, religion, etc. It is documented, for instance, in the Corruption Perception Index by Transparency International (2010) that perceptions of corruptions are different between countries. However, they are also different between groups of one and the same country (cf. Alatas et al. 2009b).

different social groups. Thus, group norms regarding corruption may emerge and influence individual decisions. If several subgroups within a society develop similar group norms regarding corruption, then whole societies may be caught in a corruption trap. Thus, an individual decision does not necessarily depend on her individual values but also on social norms that have emerged endogenously, i.e. within a group. We may ask which factors promote the evolution of a specific social norm within a group, for instance a behavioural norm of pro-corrupt behaviour that all individuals of a group follow. Certain factors influence such a norm, e.g. individual preferences of group members, group size, fluctuation of members, or entry and exit barriers to the group (cf. Abbink 2004, for the effect of staff rotation, also Schikora 2010, 36-76). The emergence of stable equilibria such as norms of pro-corrupt behaviour is of particular interest for economic research because social norms which emerge endogenously in groups may constitute Nash equilibria. Thus, once a norm of pro-corrupt behaviour has established, it becomes a stable equilibrium. Hence, negative externalities as a consequence of corruption become persistent and may inhibit social development. Then, only a 'big-push' in the form of an exogenous shock may bring a society out of such a corruption trap (e.g., Collier 2000).

The present experimental literature does not address these problems on the emergence and persistence of pro- or anti-corrupt behaviour sufficiently. Particularly, we suggest testing in repeated games for variables which have an influence on the formation of such behaviour in groups. The only recent exception in this direction is Schikora (2010, 36-76). A closely related topic is the investigation of network formation. Particularly, those factors that lead to the establishing of networks with *negative* network externalities have not been investigated by experimental research in detail. However, it is known from many contexts that networks exhibit negative externalities for third parties as well as for some network members.[6] The appearance of negative network externalities can be set within the context with topics related to corruption. Thus, economists and other social scientists should pose the question which factors mitigate and constrain negative externalities of networks, and thus avoid the emergence of 'cultures

of crime' or 'corruption traps'. Such a focus on endogenous variables may go hand in hand with the already identified exogenous variables that seem to influence corrupt behaviour in one way or another.

(3) Integrating Research Methods: Now we turn to the final aspect, i.e. applying research methods from different disciplines as complementary tools to economic experiments. Abbink (2006, 436) also emphasizes an aspect of this issue when he calls for "stronger links between field and laboratory research". However, we go one step further and would not include only experiments but also methods in the neighbouring fields. We have already emphasized the importance of considering individual perceptions of norms and within-group dynamics in experiments. Here it could be fruitful for economists to employ insights applied in other sciences. This does not only refer to methodological issues but also to available results derived through other methods. The sheer acceptance of results derived solely by incentive compatibility methods may restrict potential insights and be an obstacle in the specific context of corruption. Particularly, if the aim of corruption experiments is to derive insights on mechanisms which can be used for developing policy measures, then a combination of experiments with other methods seems to be reasonable. The investigation of corruption has produced abundant literature in disciplines such as Anthropology, Criminology, Development Theory, Organizational Studies, Political Science, Psychology, and Sociology. Thus, a large methodological toolbox is at hand: surveys, in-depth interviews, participant observation and case studies are well established methods in other social sciences. Findings obtained by these methods can be used as complements to economic experiments, as they might allow for synergetic effects. A general rejection of non-incentive compatibility methods limits the possible insights. Especially where an incentive compatible design is impossible – where participants are asked to reveal their values or other information they might not be aware of – Economics can gain from e.g. in-depth interviews. After all, economists collect personal data after most of the economic experiments, without this post-experimental questionnaire being incentive-compatible.

This paper has striven to provide a survey of the fast growing literature in experimental economics on corruption and corrupt behaviour. The topic has only recently gained attention by experimental economists. We have outlined some issues which we consider

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[6] Gatti et al. (2003, 5-6) mentions a number of empirical studies on corruption and networks.

important after having reviewed the literature. We expect a severe impact of experimental research not only on understanding the fundamental causes of corruption but also on developing tools to fight against it and thus to promote growth and social well-being.

Acknowledgments

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The 'Drop of Honey Effect'.
A Note on Chaos in Economics[a]

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Abstract – **Relationships in non-linear systems are unstable. Considering that, chaos theory aims to understand and to explain the unpredictable aspects of nature, social life, uncertainties, nonlinearities, disorders and confusion. Small differences in initial conditions - such as those due to rounding errors in numerical computation – may perform diverging outcomes tracking to systems' chaotic behaviour. In these circumstances, long-term predictions become impossible in general. A brilliant metaphor on this is the so-called butterfly effect, about the way how the "flapping of the wings of a butterfly" may cause huge phenomena either they are physical, atmospheric or social. In this work, the drop of honey effect metaphor is proposed for representing this kind of butterfly effect for chaos in social phenomena, in particular in economics and politics.**

Keywords - *Chaos, Drop of Honey Effect, Economics, Politics.*

1. Introduction

Small differences in initial conditions may cause diverging outcomes in systems and, sometimes, cause a chaotic behaviour. In these circumstances, long-term predictions become impossible. This happens even though these systems are deterministic, meaning that their future behaviour is mainly determined by their initial conditions, with no random elements involved. The deterministic nature of these systems does not make them predictable.

The chaos theory results from natural scientists' discoveries in the area of non-linear dynamics. The importance of related models has increased in the last decades, by studying the temporal evolution of non-linear systems. Considering that relationships in non-linear systems are unstable, chaos theory aims to understand and to explain this kind of unpredictable aspects. This represents a disarray connection, but basically it involves much more than that.

The relevance of this kind of theories has been well recognized to explain social phenomena and has permitted new advances in their study. Chaos theory has been applied, particularly in the context of economics or politics, for example. This paper aims to make a short reflection on chaos theory in terms of the interpretation of social aspects, considering a new concept that characterizes this kind of effects: the "drop of honey effect" from the marvellous tale written by the Armenian poet Hovanés Tumanian (1869-1923).

2. Chaos and Social Systems

The understanding of inherently nonlinear phenomena present in social systems (in particular in the political or in economic systems, studied in this paper) shows that it is possible to use mathematical models in the analysis of the social environment and socio-economic and political issues. Moreover, when this does not happen, some kind of qualitative analysis is yet possible to perform by following the ideas of chaos theory.

In the study of social phenomena, the scientific object is by definition far different from the one in natural sciences. As I Font and Régis (2006) say, citing Prigogine and Nicolis (1989), social and political scientists find out that "a high degree of unpredictability of the future is the essence of the human adventure". Some studies and research projects have assumed, in the two last decennia, that chaos theory concepts and tools are inherently part of the properties of the political science. Many studies deal with this subject by analysing situations of sensitivity to initial conditions, considering bifurcations, or entropy, for example, and use the chaos' vocabulary to describe political behaviours

and phenomena, for instance (see I Font and Régis, 2006).

3.   The Tale

In order to introduce the concept "The Drop of Honey Effect", it is interesting to present a free version of Tumanian's tale that supports the concept and its use as a metaphor for the chaotic behaviour in social systems.

On a warm afternoon, on the second floor of a splendid palace that overlooked the market place of the city, sat a king and his minister. While the king was eating some puffed rice on honey, he looked over his land with satisfaction. What a prosperous city he ruled. What a magnificent city.

As he was daydreaming, a little drop of honey dripped from his puffed rice onto the window ledge.

The minister was about to call a servant to wipe up the honey, when the king waved a hand to stop him. "Don't bother, it's only a little drop of honey, it's not our problem."

The minister watched the drop of honey slowly trickle down the window ledge and land on the street below.

Soon, a buzzing fly landed on the sweet drop of honey.

A nearby lizard shot out its long tongue and caught the fly.

The lizard was taken by surprise when a cat leapt on it.

The cat was pounced on by its worst enemy the dog that had broken free from its chain.

Meeowing and barking erupted from the street below the King and his minister. The minister was about to call a servant to go and deal with the brawling cat and dog when the king said, "Relax, the cat and dog belong to the market people. We shouldn't interfere. It's not our problem."

The cat's owner was horrified to see her cat being attacked by the big bully of a dog and started whacking the dog with her broom. The dog's owner was horrified to see her dog being attacked by the big bully of a cat and started whacking the cat with her broom.

Soon, people started coming out from their stalls and houses to see what all the screaming and shouting was about. Seeing their friend's cat being attacked, they joined in berating the dog and its owner. Others, seeing their friend's dog being

attacked by the cat, also joined in. Very quickly, the shouting became violent and a fight broke out in the street.

The worried minister turned to the King but his only comment was, "Not our problem. Here, have some more puffed rice and honey." The king and his adviser ate as they watched the fray below.

Soon the police were called in to break up the fight, but the people were so angry, each side convinced that they were right, (right about what, they couldn't remember). They started attacking the policemen. The fight rapidly broke out into a full-scale riot.

The king eyed the minister and said, "I know what you are thinking, but the army will handle it. Besides, this is not our problem."

The riot swiftly escalated into a civil war with looting and destruction all over the city. Buildings were set alight and by nightfall, the magnificent city was reduced to a pile of smoking ashes. The king and his minister stood spellbound rooted to the spot where they had been watching all day. Their mouths were hanging open in horror.

"Oh…" said the king quietly, "maybe the little drop of honey WAS our problem." (freely adapted).

4.   Occurrence of Chaos in the Economy

In economics (and in politics), chaos may be found in many situations.

Simple facts, since immemorial times, with no visible significant consequences at first sight, would register considerable impacts.

Such kind of situations goes on occurring in our time for a lot of socio-political contexts around the world. The recent "Arabian Spring" is an example of how the "butterfly effect" can be found when causing a wide spread regional political reform in the political regimes of some countries in that geographical area. The "flapping of the butterfly wings" may be represented by the immolation by fire of a Tunisian salesman that was the starting point for the regime change in Tunisia first and then the contagion to Egypt and Libya. The consequences would be seen as well in Syria where a civil war is yet in course. The "butterfly effect" could also be named as the "drop of honey effect", which is very suggestive for socio-political events. Instability in this region traditionally has huge consequences in economic area at world

level, once their raw materials are strongly demanded worldwide.

Presenting another example and considering the political situation in Greece in May 2012, a new stage came to be studied for Greek, European and World economy. The political status quo was broken in Greece: a new party took an advantage that it had never had. In fact an emergent crisis in Greece was severely felt after the Greece-Troika agreement. Throughout this Program, Greece has to respect an austerity program in order to put national budgeting at acceptable levels and is complied to obey the agreement that is conducting Greek people to severe self well being sacrificing. This situation led Greeks to vote in favour of a new situation in the first round elections. Although the second round kept the status quo in the political situation, the truth is that this could become an entire new situation that could impose a new socio-economic condition to European Union and to the World that could threat the world economic stability. The possible bankruptcy in Greece was tormenting world leaders; a new status quo was being prepared for Europe with considerable implications for the whole world. This scenario was adjusted after the second round elections, but the alert was there.

Anyway, the direct economic impact of Greek situation is felt in international financial markets and had immediate strong economic implications, first felt in the Euro zone economy and then spread worldwide.

5.   Conclusions

Historically, there are a lot of simple facts, considered insignificant in the moment but that would have big consequences. In fact in a completely unexpected way, they would have huge impacts that could not be guessed at the very initial moment. They are good illustrations of situations for which the output is not directly proportional to the input.

The case of the Tunisian salesman working as the starting point for the regime change in Tunisia first and then the contagion to Egypt and Libya, and then to Syria, is shown in the paper.

The "Arabian Spring" was presented in this work as an example of the way how the "butterfly effect" can be found when causing a wide spread regional political reform in the political regimes of some countries in that geographical area. Consequent and significant economic changes in the system of these countries got inevitable.

The "drop of honey effect" may be represented by the immolation by fire of a Tunisian salesman.

Acknowledgements

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