The Financial Crisis of 2007-2009 in the Non-Financial Firms of the PSI-20 and IBEX-35

Dynamic of Indicators and the Impact on Technology

Francisco R. Vale
Center for Management Studies
Instituto Superior Técnico – UTL, Lisbon, Portugal
francisco.roquevale@gmail.com

Abstract

This paper studies the impact of the international financial crisis of 2007-2009 in a representative group of large non-financial firms in Portugal and Spain (PSI-20 and IBEX-35). Countless books, articles, theories and opinions are written on the impact that financial crises have on the economy and on its behavior during periods of recession. But the complete explanation of the dynamics of economic and financial crises at the firm level has not been properly systematized. This work contributes to a better understanding of the dynamics of these crises on large firms by studying a part of the problem. To this end, we analyzed economic indicators of reference and indicators from the KTC model of Fernandes (2011) during the period of 2006 to 2009 of the PSI-20 and IBEX-35 non-financial firms. The indicators were analyzed individually, comparatively and, where appropriate, compared to the performance of the respective real economy.

Keywords: Financial Crises, Economic Indicators, Technology Value, PSI-20, IBEX-35.

I. Introduction

This paper deals with the issue of the impact of financial crises on a firm level, specifically with the economic impact of the 2007-2009 international financial crisis in large firms.

Throughout history, particularly since the late nineteenth century [1], the world has faced several financial crises and recessions that are inevitably part of economic cycles [2]. The 2007-2009 international financial and economic crisis had a strong impact on the world economy, causing the greatest economic downturn since World War II. Yet, this crisis was the deepest, most synchronous across countries and most global since the Great Depression of the 1930s, its best benchmark [3].

Over the years, countless books, articles, theories and opinions have been written about the impact that financial crises have on the economy and on the behavior of economies during periods of recession. However, research for this study found no detailed studies on the dynamics of individual firms or sectors of the economy during financial and economic crises. On one hand, complete explanation of the dynamics of an economic and financial crisis at the firm level has not been properly systematized. On the other hand, there are difficulties in obtaining the necessary information on the firms in each country in a harmonized way [4].

Thus, this paper contributes for a better understanding of the economic impact of financial crises on firms. To this end, we studied the evolution of relevant economic indicators of a group of large firms, specifically the non-financial firms of the PSI-20 and IBEX-35 stock market indexes (from this point forward just called "PSI-20" and "IBEX-35"), during the four years period of 2006 to 2009 which covers the recent global financial crisis. Additionally, in order to assess the impact of financial crises on the usage, value and acquisition (investment) of technology we studied the dynamics of indicators related to the value added by the use of the production factors Knowledge, Technology and *Capital* (KTC) as defined in the KTC production model [5]. To differentiate the concept of *Capital* of the KTC model [5] from the classical concept of Capital (that includes both *Capital* and Technology), *Capital* is written with a different font and in italic.

The main objective of this paper is to answer the following question: What was the impact of the 2007-2009 global financial and economic crisis[1] on the non-financial firms of the PSI-20 and IBEX-35?

To achieve the objective proposed we organized the answer in three criteria: 1- Individually, comparably to each other and, when thought appropriated, comparably to its respective real local economy[2], in terms of: 1.1- Dimension; 1.2- Gross Value Added (GVA); 1.3- Inventory; and 1.4- Efficiency; 2- Investment in general and technology in particular. 3- In the parts of the value added by the use of: 3.1- Knowledge; 3.2- Technology; and 3.3- *Capital*;

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[1] From this point forward just called "2007-2009 crisis" or "crisis".
[2] In this paper, "real economy" corresponds to the "Non-Financial Corporations" that exclude "Financial Corporations", "Government", "Households" and "Non Profit Institutions Serving Households" [6].

Section II describes the 2007-2009 crisis and summarizes the literature review in what concerns the typical economic consequences of a financial crisis on firms. Section III explains the methodology by describing the data used, its sources and the indicators analyzed. Section IV presents and discusses the results. Finally, Section V summarizes the work done in this paper, answers the proposed question and conclusions are taken.

II Literature review

The 2007-2009 crisis

The 2007-2009 had several features in common with similar financial-stress driven crisis episodes. It was preceded by a relatively long period of rapid credit growth, low risk premiums, abundant availability of liquidity, strong leveraging, soaring asset prices and the development of bubbles in the real estate sector [3]. It is assumed by Brunnermeier (2009) [7] that the crisis began in the summer of 2007 when BNP Paribas froze redemptions for three investment funds, citing its inability to value structured products. The recession in the United States of America (USA) is defined to have begun in December of 2007 [8]. However, at that point most observers were not yet alerted that systemic crisis would be a threat, but this began to change in the spring of 2008 with the failures of Bear Stearns in the United States and the European banks Northern Rock and Landesbank Sachsen. About half a year later, the list of (almost) failed banks had grown long enough to suggest that systemic meltdown was a possibility: Lehman Brothers, Fannie May and Freddie Mac, AIG, Washington Mutual, Wachovia, Fortis, the banks of Iceland, Bradford & Bingley, Dexia, ABN-AMRO and Hypo Real Estate. When in September 2008 Lehman Brothers filed for bankruptcy panic broke in stock markets and, as the European Commission (2009a) [3] describes: "*market valuations of financial institutions evaporated, investors rushed for the few safe havens that were seen to be left (e.g. sovereign bonds), and complete meltdown of the financial system became a genuine threat. The crisis thus began to feed onto itself, with banks forced to restrain credit, economic activity plummeting, loan books deteriorating, banks cutting down credit further, and so on. The downturn in asset markets snowballed rapidly across the world. As trade credit became scarce and expensive, world trade plummeted and industrial firms saw their sales drop and inventories pile up. Confidence of both consumers and businesses fell to unprecedented lows*". The economic downturn was the deepest since World War II and caused the world real GDP to fall -0,6% in 2009 from a growth of +5,0% in 2007 and +2,8% in 2008. In the Euro zone the drop was deeper with real GDP falling -4,1% in 2009 [9]. With the threat of complete meltdown of the financial system, national and international lenders of last resort all over the world responded forcefully to solve that crisis[3].

In Portugal and Spain, the crisis had a strong negative impact as well. The GVA growth rate of the Portuguese economy grew from +0,9% in 2006 to +2,8% in 2007 and then fell to +0,5% in 2008 and -1,2% in 2009. The GVA growth rate of the Spanish economy grew from +3,5% in 2006 to +4,3% in 2007 and then fell to +3,0% in 2008 and -2,2% in 2009 (See Fig. 1).
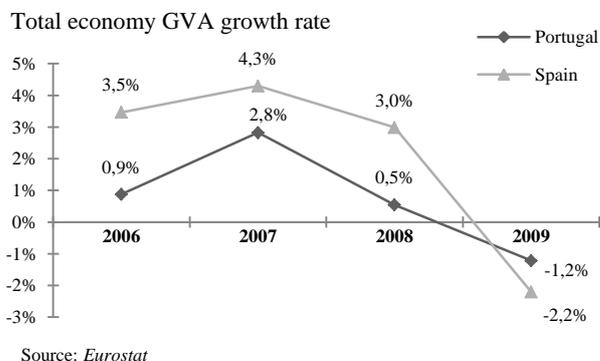

Source: *Eurostat*

Fig. 1 - Gross Value Added growth rate of the Portuguese and Spanish total economies (2006-2009)

The GVA growth rate of the Portuguese real economy had a similar behavior with that of the total economy. It also grew in 2007 and fell in 2008 and 2009. The GVA growth rate of the Spanish real economy had a different behavior from that of the total economy. It also grew in 2007 but then grew again in 2008 and fell more sharply in 2009 (See Fig. 2).
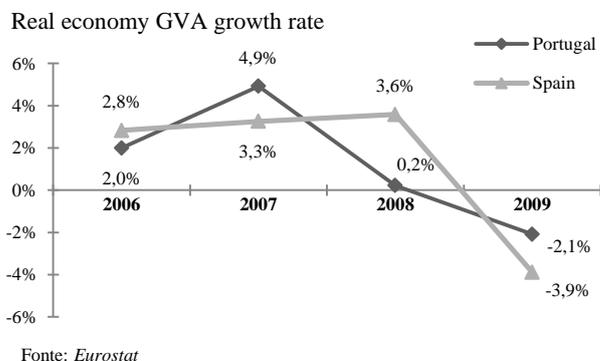

Fonte: *Eurostat*

Fig. 2 - Gross Value Added growth rate of the Portuguese and Spanish real economies (2006-2009)

Typical consequences from a financial crisis

There are many thoroughly studied economic consequences from financial crises on a macroeconomic level. However few can be easily extrapolated to the firm level and are properly systematized, as Claessens, Kose & Terrones (2008) [4] point out. We will summarize some of the expected economic consequences of a financial crisis and consequent recession on a firm level.

Typically, after financial crises and its following recessions investment levels tend to fall sharply, including inventories [10]. Haugh, Ollivaud & Turner (2009) [11] also point to the trend of firm investment and

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[3] Although just moving the "bad debt" from private to public ownership, thus merely postponing what might be a significant

adjustment in the world's financial system, as we are now (2011) witnessing.

residential investment to fall sharply during crises. This fall might be even more severe if investments are characterized by sunk costs [12]. The levels of employment are also seriously affected, as well as Labor Productivity. Usually, unemployment keeps rising during two or three years after the financial distresses [13] normally due to the influence of the hysteresis effect [14]. Labor Productivity (in this case, referring to the value of output per hours worked) tends to decline due to the higher decrease in the output compared to the decrease in the number of hours worked [10]. However, this not always occur as big parts of the stock of capital might become obsolete and thus removing the less efficient parts, which can have a positive effect on productivity by producing more with less inputs [15]. Finally, Research & Development (R&D) expenses also tend to decline as, in a time of lower revenues, R&D is one the easiest cost segments to cut [16].

As for the impact of crises in technology, Fernandes (2011) [5] suggests that, in theory, in a period of contraction in GVA, the Value of Technology tends to fall due to a decrease in *Capital* liabilities, which is connected to investment.

This information was useful to interpret the results of the indicators of the PSI-20 and IBEX-35.

III Methodology

The data

To achieve the objective proposed it was necessary to use data from the group of non-financial firms of the PSI-20 and of the IBEX-35, as well as some macroeconomic data to compare with the firms' indicators. To obtain the macroeconomic data we used the Eurostat database [6]. To get the PSI-20 and IBEX-35 data, we used the BDTec database [17], containing the annual accounts of these firms, as well as an aggregator that made it possible to study the group of firms of the PSI-20 and of the IBEX-35 as two single firms. The PSI-20 and IBEX-35 data from the BDTec also provided the data needed for the KTC model of Fernandes (2011) [5]. Additionally, we had to adjust the annual data (from 2006 to 2009), both the Eurostat's and the BDTec's, to account for inflation, thus converting it to 2006 prices (constant prices).

A detail we had present along the whole analysis of the results was the fact that the firms' data corresponds to the ones listed in December 31st of each year. This means that at any given year, the list was not composed by the exact same firms of the year before because some were excluded and replaced by others. Potentially, this might affect the results of GVA, Turnover and every other indicator due to, for example, the addition a firm with a significantly bigger dimension compared to the excluded one.

Indicators used

To analyze the firm's dimension it was used the indicators Turnover, Number of Employees (Employment) and Total Assets [18].

In order to study inventory levels it was used the indicator Inventory Scale [19] that relates the value of Inventory with the value of Total Assets.

To characterize efficiency, it was studied the indicators Unitary Labor Cost and Labor Productivity (measured by the number of employees).

To study investment in general we used the indicator Gross Fixed Capital Formation (GFCF) and to study investment in technology in particular we used the evolution of the Value of Technology[4] (VT) and of the Value of *Capital[5]* (*VC*). Though, it had to be paid attention to the fact that the VT and the *VC* do not count with the depreciations of Technology and *Capital*, respectively, and thus cannot be directly interpreted.

Finally, for the study of the production factors KTC [5], we used the indicators Knowledge Incorporation Index (KI), Technology Incorporation Index (TI) and *Capital* Incorporation Index (*CI*). The incorporation indexes of the KTC production factors measure the relative contribution of the value added by the use of each factor for the GVA. Note that the KI is calculated in the same way as the Unitary Labor Cost, as Knowledge (L) equals Salaries and Social Benefits costs. Typically, in a recession period, L tends to fall and the opposite in periods of expansion [5]. As for the KI, other variables might influence its evolution like efficiency gains.

IV Results and Discussion

Firstly, it was calculated the weight of the Construction and Real Estate economic sectors in the PSI-20 and IBEX-35 to control for its expected influence on the economic indicators, since these were the most negatively affected sectors in the 2007-2009 crisis [20]. These calculations were made for the indicators Turnover, Total Assets and GVA. The results of the three indicators all showed similar results, showing a much higher representation of these sectors in the IBEX-35 than in the PSI-20 (Table I).

Table I - Weight of the Construction and the Real Estate economic sectors in the PSI-20 and IBEX-35

PSI-20: Construction and Real Estate sectors	2006	2007	2008	2009
Number of companies*	1	1	3	2
Percentage of total Turnover	4,3%	3,1%	7,0%	6,5%
Percentage of total Total Assets	2,6%	3,9%	8,2%	6,8%
Percentage of total GVA	3,1%	3,4%	8,4%	6,7%

IBEX-35: Construction and Real Estate sectors	2006	2007	2008	2009
Number of companies*	5	4	5	6
Percentage of total Turnover	13,9%	16,2%	20,0%	25,1%
Percentage of total Total Assets	18,5%	19,6%	22,1%	24,1%
Percentage of total GVA	13,0%	17,1%	18,9%	26,5%

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[4] See Fernandes (2011) [5].
[5] See Fernandes (2011) [5].

Dimension

The PSI-20's Turnover grew in 2007 (+48%) and in 2008 (+19%) and fell in 2009 (-8%). The number of employees grew every year but more sharply in 2008 (+25%). The value of Total Assets also increased in every year. In 2007 it increased +26% and in 2008 and 2009 it grew +15% and +17%, respectively (Table II). The IBEX-35's Turnover had a different behavior. It grew +9% in 2007, fell sharply in 2008 (-21%) and kept decreasing in 2009 (-3%). The number of employees had an ample increase in 2007 (+54%), decreased sharply in 2008 (-27%) and grew again in 2009 (+16%). The value of Total Assets presented a similar trend than that of employment. It grew in 2007 (+14%) and 2009 (+7%) and fell in 2008 (-19%) (Table II). The PSI-20 firms clearly gained dimension in every period, contrary to the IBEX-35 firms which had a sharp decrease in 2008. In relation to each other, the results of Table II show that the IBEX-35 is a few times larger than the PSI-20. However, it also shows that the PSI-20 gained relative dimension to the IBEX-35 during this four years period, especially in 2008. The sharp decrease in the IBEX-35's dimension in 2008 can be explained by the fact that the Construction and the Real Estate sectors weight much higher in the IBEX-35 than in the PSI-20 (Table I).

Table II - Dimension indicators' percentage year-on-year change and relative dimension

% change year-on-year	2006	2007	2008	2009
PSI-20				
Turnover	N/A	48,3%	19,1%	-7,7%
Employment	N/A	8,1%	24,8%	4,0%
Total Assets	N/A	26%	15%	17%
IBEX-35				
Turnover	N/A	8,5%	-21,1%	-2,5%
Employment	N/A	54,0%	-27,2%	15,9%
Total Assets	N/A	14%	-19%	7%
Relative dimension	**2006**	**2007**	**2008**	**2009**
Turnover				
PSI-20 / IBEX-35	0,14	0,19	0,29	0,27
IBEX-35 / PSI-20	7,17	5,25	3,48	3,67
Employment				
PSI-20 / IBEX-35	0,19	0,13	0,23	0,21
IBEX-35 / PSI-20	5,24	7,47	4,36	4,85
Total Assets				
PSI-20 / IBEX-35	0,13	0,14	0,21	0,23
IBEX-35 / PSI-20	7,60	6,91	4,87	4,44

Gross Value Added

The PSI-20's GVA increased in every year, with the biggest increase happening in 2007 (+22%). The IBEX-35 also increased its GVA in 2007 (+7%) but had a big drop in 2008 (-22%) and recovered in 2009 (+7%). Both groups of firms had a visibly similar trend, although less positive for the IBEX-35 (Fig. 3). Between 2007 and 2009, the period of financial crisis, the PSI-20's GVA increased +11% and the IBEX-35's decreased -16%.

GVA growth rate
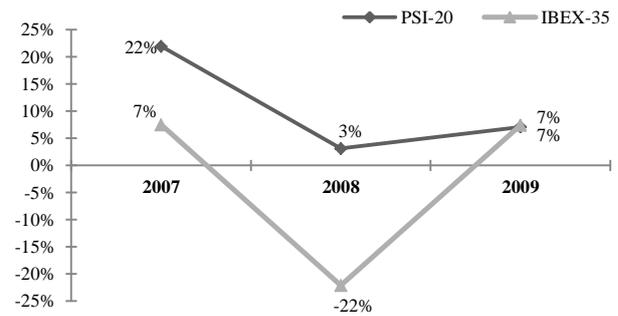
Fig. 3 - PSI20's and IBEX-35's GVA growth rates

These results show that IBEX-35 was more adversely affected by the crisis, while the PSI-20 was able to maintain a positive performance in terms of GVA in the same period. However, changes in the constitution of the indexes in each year may have influenced the evolution of the GVA. To control for this effect we calculated, for each year, the difference between the sum of the GVA of newly listed firms (in year t) and the sum of the GVA of exiting firms (in year t-1) and then divided the result by the sum of the GVA of all the listed firms (in year t). Since the GVA of the exiting firms always referred to the GVA in the previous year (t-1) and to compensate for the high probability that it changed in year t, we assumed an equal increase to that of the total GVA of the group of firms. This calculation is represented by the following equation:

$$\text{Impact} = (\Sigma \, GVA_t^{\,n} - \Sigma \, [GVA_{t-1}^{\,m} \cdot (\, GVA_t^{\,i} / GVA_{t-1}^{\,i} \,)] \, / \, GVA_t^{\,i} \quad (1)$$
With t = year, n = new firm, m = exiting firm, and i = Firm set (PSI-20;IBEX-35)

In fact, the changes in the PSI-20 index constitution in 2007 resulted in +16% of GVA compared with the GVA that would have resulted if any changes were made to the index constitution (Table III). This could explain the large increase in the PSI-20's GVA in that year. The same happens in 2008, suggesting that without the +6% increase in GVA caused by newly added firms the PSI-20's GVA could have decreased in that year. For the IBEX-35 the changes in the index in 2007 and 2008 appear to have a negligible effect in the GVA. In 2009, some of the IBEX-35's GVA growth might be explained by the newly listed firms.

Table III - Influence of newly listed firms on the groups' GVA evolution

Influence (%) of newly listed firms on the groups' GVA evolution	2007	2008	2009
PSI-20	16,2%	5,9%	2,6%
IBEX-35	-0,3%	-1,3%	4,2%

Comparing the evolution of the PSI-20's GVA with that of the Portuguese real economy (Fig. 2), we can see that they both had strong growth in 2007 and slightly grew in 2008 but showed different behaviors in 2009. While the Portuguese real economy went into recession, the PSI-20 increased the GVA's rate of growth. This suggests that the PSI-20 adapted positively to the harsh local economic conditions and, recalling the Turnover decrease in 2009 (Table II), the explanation appears to be

in an increase of Intermediate Costs efficiency. We calculated the Pearson Correlation Coefficient that resulted in a value of 0,77, confirming a positive correlation between the PSI-20's GVA and that of the Portuguese real economy, at least for 2007 and 2008.

The evolution of the IBEX-35's GVA was similar to that of the Spanish economy in 2007 (Fig. 2). However, in 2008 and 2009 it was apparently the opposite. While the Spanish real economy's GVA growth rate grew in 2008, the IBEX-35's plummeted. In 2009, while the real economy fell into recession, the IBEX-35's GVA recovered (+7%). The Pearson Correlation Coefficient of -0,69 also confirms a moderate correlation between the two but now in opposite direction.

Inventory Scale

The PSI-20's Inventory Scale increased +1,6pp in 2007 and +0,2pp in 2008 and decreased -1,0pp in 2009. The Inventory Scale of the IBEX-35 decreased in every year with a bigger drop happening in 2008 (-1,1pp) (Fig. 4).
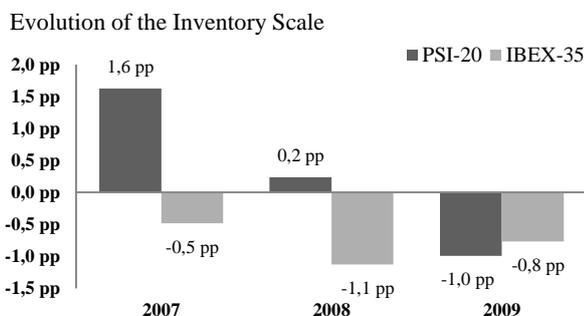

Fig. 4 - Evolution of the PSI-20's and IBEX-35's Inventory Scale

As mentioned in the literature review, investment in inventory (and thus inventory levels) tends to fall during financial crises. Accordingly, the PSI-20's results are in line with this as they present a similar behavior to that of the GVA of the Portuguese real economy (Fig. 2). The calculated Pearson Correlation Coefficient of 0,83 confirms the correlation between the two.

The IBEX-35's Inventory Scale fell in every year and thus the Pearson Correlation Coefficient of -0,53 confirms a weak correlation with the GVA of the Spanish real economy.

Perhaps the fall of the Inventory Scale in 2007 was due to an increase in uncertainty about the future of the economy and of the business of the construction and real estate firms of the IBEX-35 as the real estate crisis started in mid-2007 in the United States of America. In 2008, the deterioration of the business outlook caused by the sharp fall in GVA of the IBEX-35 and the worsening of the international financial crisis (Section 2.1), easily explain the greater decrease in the Inventory Scale. In 2009, the decline of the Inventory Scale was also in line with the expected behavior.

Unitary Labor Costs

The Unitary Labor Costs (ULC) in the PSI-20 decreased -1,2% in 2007, increased +2,7% in 2008 and

decreased again in 2009 (-4,3%). As for the IBEX-35, the value of this indicator increased in the three years, notably in 2008 and 2009 (Table IV).

Table IV - Unitary Labor Costs and percentage change year-on-year

Unitary Labor Costs	2006	2007	2008	2009
PSI-20	0,267	0,264	0,271	0,259
Change year-on-year		-1,2%	2,7%	-4,3%
IBEX-35	0,239	0,244	0,269	0,292
Change year-on-year		1,8%	10,4%	8,8%

These results suggest an increase of efficiency in PSI-20 (except in 2008), and a continuous decrease in IBEX-35. The ULC values of PSI-20 are higher than the ones of IBEX-35 in the first three studied years, which is in line with the conclusions of Serrano Cinca et al. (2005) [21] that the ULC of smaller firms tend to be larger than the ULC of larger firms. The trend in the period of 2006 to 2009 was of approach between the ULC of the two groups of firms, with the IBEX-35 surpassing the PSI-20 in 2009. This trend is also in line with Serrano Cinca et al. (2005) as the PSI-20 gained dimension relatively to the IBEX-35 along the four years. The fact that, in 2009, the value of PSI-20's ULC exceeds that of IBEX-35 suggests that the PSI-20 has become more efficient in personnel expenses for the generation of added value despite their smaller dimension. This efficiency gain is in line with the previously suggested reason for the PSI-20's GVA increase in 2009, despite the decrease in Turnover and the recession in the Portuguese economy.

When comparing the PSI-20's ULC with that of the real economy, the calculated Pearson Correlation Coefficient of -0,38 shows no correlation between the two. As for the IBEX-35, its ULC shows a strong correlation (-0,84), in opposite direction, with the ULC of the Spanish real economy.

Labor Productivity

The Labor Productivity of the PSI-20 had a similar evolution to that of the ULC (in terms of efficiency gain). It increased in 2007 (+13%) and 2009 (+3%) and decreased in 2008 (-17%) (Fig. 5). These results suggest an increase of efficiency in 2007 and 2009 and a sharp decrease in 2008, like with the ULC. The IBEX-35's Labor Productivity clearly showed an evolution opposite to that of the PSI-20, registering a sharp decline in 2007 (-30%), a slight recovery in 2008 (+7%) and then declining again in 2009 (-7%) (Fig. 5). Contrary to the results of the ULC, the IBEX-35 showed an increase in efficiency in 2008, although after a large fall in 2007.
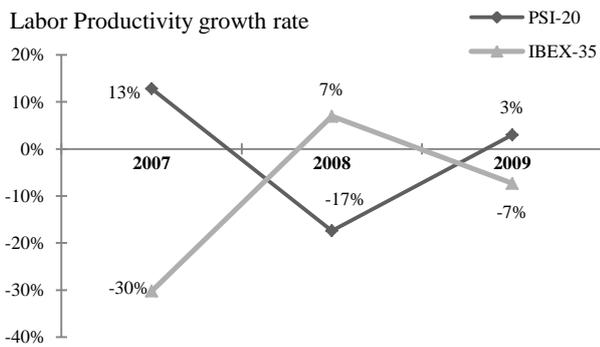
Fig. 5 - PSI-20's and IBEX-35's Labor Productivity growth rate

Investment

In the PSI-20, the Gross Fixed Capital Formation (GFCF) was positive in every year. In the IBEX-35, the GFCF was positive in 2007 and 2009 but negative in 2008 (Table V). For both sets of firms these results are in line with evolution of their GVA. This confirms that firms' investment tends to decrease in periods of GVA contraction but not necessarily in periods of financial crisis in the overall economy, as it increased in 2007 and 2009. It seems to evolve independently of the real economy. Note that as the PSI-20's GVA growth rate decreased from +22% in 2007 to +3% in 2008 (Fig. 3), the GFCF, although positive, also decreased.

Table V - Gross Fixed Capital Formation and change year-on-year (%)

Gross Fixed Capital Formation	Unit	2007	2008	2009
PSI-20	M€	21.908	17.910	24.845
Change year-on-year		N/A	-18,3%	38,7%
IBEX-35	M€	93.977	-105.812	91.517
Change year-on-year		N/A	-212,6%	186,5%

As Fernandes (2011) [5] suggests, in theory, the Value of Technology (VT) tends to fall in a period of contraction in GVA, due to a decrease in *Capital* liabilities. In PSI-20, this trend verifies. GVA grew every year and the same happened with the VT while the Value of *Capital* (*VC)* decreased (Fig. 6).
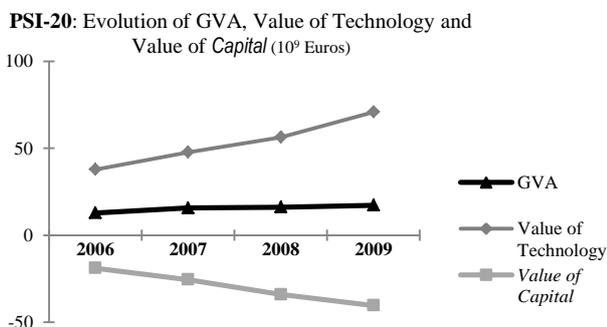

Fig. 6 - Evolution of PSI-20's GVA, Value of Technology and Value of *Capital*

In IBEX-35, that trend did not apply (Fig. 7). In 2007 the *VC* increase simultaneously with the VT. This means a higher increase in *Capital* Assets than in *Capital* Liabilities, which may be due to financial gains. In 2008,

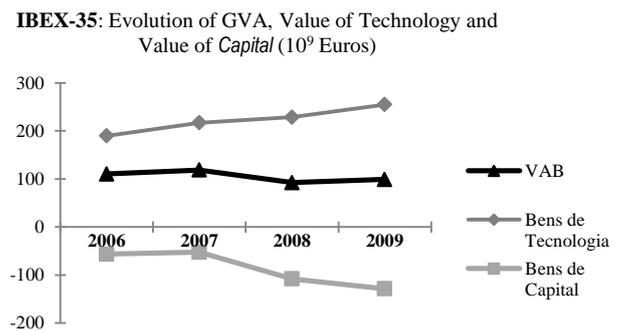the VT increased while the GVA declined. However, note that the VT increase was less pronounced.

Fig. 7 - Evolution of IBEX-35's GVA, Value of Technology and Value of *Capital*

The evolution of the value of VT cannot be directly used for the interpretation of the impact of crises on investment in technology because, to do so, it would require the accounting of the depreciation of the VT in order to obtain the GFCF for the VT. Nonetheless, when comparing the PSI-20's and IBEX-35's CFCF with the evolution of its respective VT, the resulting Pearson Correlation Coefficients of 0.89 for the PSI-20 and of 0,95 for the IBEX-35, show a strong correlation between the two indicators. This suggests that the evolution of VT is also positively related to that of the GVA. Thus, in periods of decrease in the firm's GVA growth, investment in technology, which is basically equipment, tends to fall, reflecting a decrease in *Capital* liabilities and a consequent decrease in the VT which is normally generated by the latter.

Incorporation indexes of the KTC production factors

The Knowledge Incorporation Index (KI) of PSI-20 decreased by -0,3pp in 2007, increased by +0,7pp in 2008 and fell -1,2pp in 2009. Consequently, the Technology Incorporation Index (TI) combined with the *Capital* Incorporation Index (*CI*) increased in 2007, decreased in 2008 and increased again in 2009. Individually, the TI fell in 2007 and increased in 2008 and 2009. The *CI* showed an opposite evolution, growing in 2007 and declining in 2008 and 2009 (Fig. 8).

As already mentioned, in crisis period, the added value by the use of Knowledge (L) tends to decline and to happen the opposite in expansion period, which happened in PSI-20: every year both GVA and L increased. The KI did not show the same relation with GVA but that is explained by the influence of labor costs. As for the added value by the use of Technology (T), the PSI-20's results also show a positive relation with GVA evolution. This relation did not apply for the added value by the use of *Capital* (*C*). In 2007, to an increase in GVA corresponded a rise in C but, in 2008 and 2009, the relation between the two was opposite. Note that for small GVA variations corresponded small negative variation in *C*, while for sharp GVA variations *C* also increased significantly.

The evolution of both TI and *CI* in PSI-20 did not show a clear relation with the GVA evolution. However, the TI variations seem to follow an opposite trend to that

of the Turnover (Table II). In fact, when correlating the two, the Pearson Correlation Coefficient of -0,98 confirms a strong opposite relation. When Turnover declined the TI increased, and vice-versa. Since CI showed an approximately opposite evolution to that of the TI, its evolution should reveal a positive correlation with the variations in Turnover. Indeed, the Pearson Correlation Coefficient of 0,90 confirms it. Since the PSI-

20's Turnover had an evolution similar to that of the total economy GVA growth (Fig. 1), it can be inferred that the relative contribution of C for the VAB (CI) tends to decrease with financial crisis and the opposite happening to the TI. This could be consequence of lower *Capital* gains caused by the financial crisis.

PSI-20: Evolution of the Incorporation Indexes KI, TI e *CI*
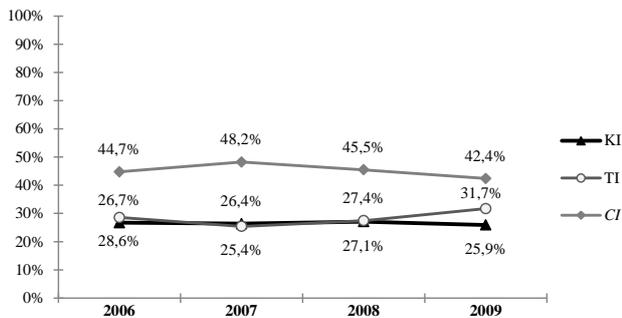
PSI-20: Evolution of total GVA and of the GVA by the use of L, T and C (10^9 Euros)
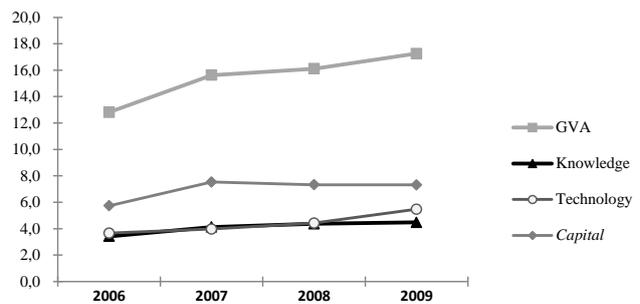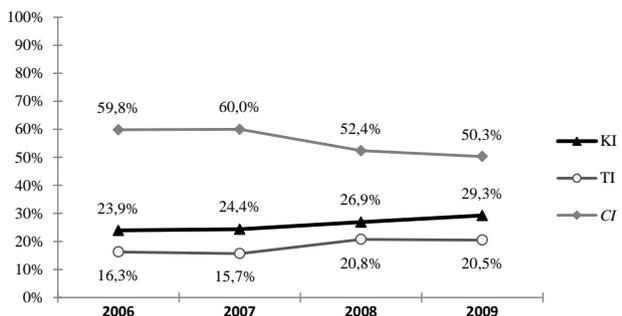

Source: BDTec

Source: BDTec

Fig. 8 - Evolution of the PSI-20's Incorporation Indexes KI, TI and *CI* and of GVA and its parts L, T and C

The IBEX-35's KI grew in every year, as analyzed for the ULC, and consequently the TI and *CI* combined declined. Individually, the TI decreased in 2007, increased in 2008 and decreased again in 2009. The *CI* grew slightly in 2007 (+0,2pp) and decreased in 2008 and 2009, with a higher decline in 2008 (-7,6pp) (Fig. 9). In the IBEX-35, L and C showed a positive relation with the evolution of GVA. The value added by the use of Technology also appeared to have a positive relation with GVA in 2007 and 2009 but, in 2008, it increased while GVA decreased.

The IBEX-35's TI evolution revealed an apparently opposite trend to that of the GVA. The *CI* had an evolution in line with that of the total economy's GVA, as with PSI-20's *CI*.

We calculated the Pearson Correlation Coefficients of the relation between the TI and *CI* with the Turnover and the results of -0,95 and 0,99, respectively, confirm the same relation found in PSI-20: The TI declines with a Turnover increase and the opposite happens with the *CI*.

IBEX-35: Evolution of the Incorporation Indexes KI, TI e *CI*

IBEX-35: Evolution of total GVA and of GVA by the use of L, T and C (10^9 Euros)
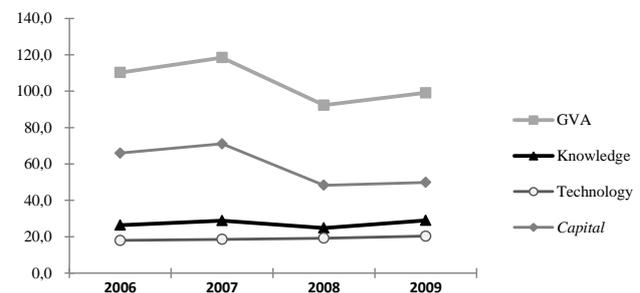
Source: BDTec

Source: BDTec

Fig. 9 - Evolution of the IBEX-35's Incorporation Indexes KI, TI and *CI* and of GVA and its parts L, T and C

V Conclusions

This paper studied the impact of the financial crisis of 2007-2009 in a representative group of large non-financial firms of Portugal and Spain: the firms listed in the stock market indexes PSI-20 and IBEX-35. We studied economic indicators of reference and indicators of the KTC model. The results were then analyzed individually, comparably and, when appropriated, comparably with the respective real economy.

The objective proposed was to answer the following question: What was the impact of the 2007-2009 global financial and economic crisis on the non-financial firms of the PSI-20 and IBEX-35? To answer this question we gave special attention to the impact of the crisis on the firms' dimension, on its inventory levels, on efficiency, on investment in fixed capital and in technology in particular and, finally, on the contribution of the production factors Knowledge, Technology and *Capital* for GVA.

The results show that the PSI-20 firms were less adversely affected by the crisis than the firms of IBEX-35. Firstly, the PSI-20 gained dimension in all indicators and also relatively to IBEX-35. The PSI-20's cumulative GVA growth from 2007 to 2009 was +11% while the IBEX-35 showed a decline of -16% in the same period. Secondly, the PSI-20's Inventory Scale only fell in 2009 while that of the IBEX-35 fell every year, demonstrating a continuous loss of confidence in its future economic perspectives. As for efficiency, the PSI-20 had improving results in both Unitary Labor Costs and Labor Productivity, as well as a clear increase in Intermediate Costs efficiency in 2009. The IBEX-35, on the contrary, lost efficiency in each of these indicators. Finally, about the impact of the crisis on investment in fixed capital, it was confirmed that it decreases in periods of contraction of the firms' GVA and increases in periods of expansion. Nevertheless, the evolution of investment in large firms is apparently independent from the fluctuations in the real economy's GVA. The results referring to investment in technology – essentially equipment – suggest a similar behavior, reflecting a decrease in *Capital* liabilities in periods of recession and a consequent decrease of the Value of Technology that is normally generated by the former.

In general, the results also show that in 2009 the impact of the crisis on the economy of each country diverged from the impact in these sets of large Portuguese and Spanish firms. While 2009 was a year of recession in both economies and also in the real economy, for PSI-20 and IBEX-35 it was a year of GVA growth.

The impact of the crisis on the value added by the use of Knowledge proved in line with expectations, both in the PSI-20 and in the IBEX-35, as it declined in periods of the firms' GVA contraction. As for the value added by the use of Technology, it increased in every year, also in both sets of firms, regardless of the progress of their GVA. However, in the relative contribution of Technology to the GVA, the results showed a strong negative correlation with the evolution of the firms' Turnover. The value added by the use of *Capital* did not reveal a clear trend in periods of expansion or contraction of GVA, both of the firms' and of the respective economy, as the patterns in the PSI-20 and in the IBEX-35 were different. Nevertheless, the evolution of the *Capital* Incorporation Index in both sets of firms showed a strong positive correlation with the firms' Turnover, contrary to the Technology Incorporation Index. Thus, a decrease in the *Capital* Incorporation Index in a time of financial crisis and GVA contraction could be consequence of lower *Capital* gains caused by the crisis.

Although the data had some limitations, like the changings in the index constitution along the years, these results seem generally in line with what was expected. Nonetheless, further work should be done on this matter, like, for example, studying the impact of other past financial crises on similar firms or study the impact of the crisis on other indicators, such as financial ratios, Return on Equity and Return on Assets.

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