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"NEW CHALLENGES IN BUSINESS RESEARCH"

Conference Proceedings

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General Chairs

Mª Consuelo Calafat Marzal

Mª Luisa Martí Selva

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An AHP framework for property valuation to identify the ideal portfolio mix

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Abstract

This paper presents a new methodology based on the Analytic Hierarchy Process (AHP) of Saaty to evaluate the development trends of the residential trade and industry up until 2050. The purpose is an universal macroeconomic model that involves fundamental variables such as build quality and environmental social features, but also comprises the key component of demographic development, which will have strong future implications for portfolio management in the countries of the European Union 27, especially those with shrinking populations.

Keywords**:** *AHP; EU-27; 2050 real estate portfolio mix.*

Introduction

Europe is seen as the oldest continent in terms of population age. Consequently economists, demographers, historians as well as sociologists predict that demographics and ageing will represent one of the greatest economic challenges of this century (Boulmier, 2012). Major demographic developments in recent decades have already caused economies to fluctuate, affecting supply and demand in the residential trade and industry. The industry has had to react in order to stabilise, expand and avert shrinkage of its assets. Furthermore, as living is a basic need for individuals, prevention is needed to safeguard occupants' requirements (Boulmier, 2012).

This study puts forward a macroeconomic AHP model for the residential trade and industry in order to realise an asset portfolio for countries with mainly shrinking populations in the future. Therefore, Bulgaria, Estonia, Germany, Hungary, Latvia, Lithuania, Poland, Romania and Slovakia are analysed. Although Spain has a growing population, it is also the object of investigation since it is the native country of the Universitat Politècnica de València.

AHP methodology

The Analytic Hierarchy Process was created by Thomas L. Saaty in 1980 and is a technique for analysing and realising decision-making used across wide-ranging fields within the business sector (Aznar et al., 2010; Aznar et al., 2011). For Saaty and Vargas this technique is a universal theory of measurement. It is a theory that treats individuals independently from their basic circumstances (Saaty, 2005; Saaty, Vargas, 2001). The foundation of Saaty's mathematical statistical method is the creation of the AHP hierarchy with the objective in the highest level, followed by the criteria as well as sub-criteria in the next levels and finally the alternatives in the last level. In the next stages the assessment of the variables by realising pairwise comparisons and the calculations of the weights in every level is substantial, followed by the calculations of the weights of the entire AHP hierarchy. If the evaluation of the consistency ratio is plausible, the examination of the outcomes as well as the decision-making process completes the approach (Saaty, 1990).

Case study: Properties in the EU-27 in the future year 2050:

Statistical tendencies of properties in EU-27 countries

The current demographic developments in the European Union 27 have been evident ever since they began a few decades ago. The demographic changes validate key ensuing tendencies: As a result of low fertility ratios, the younger generations will decrease. In contrast, older generations will develop as the living conditions improve in societies. Consequently, age structures will shift with the impact of shrinking populations, if migration rates are not high enough to balance the populations structures.

A crucial aspect in all of these countries is that the median age has been changing and will do so in the future. While the range today lies between 38.2 in Slovakia and 45.5 in Germany, the age level for 2050 will be between 42.7 in Latvia and 51.5 in Germany (United Nations, 2013). Hence, there will be movements in the median ages with a maximum of around plus 10 years in the next 35 years. These tendencies will change the demands of inhabitants in reference to habitations, which will have to be constructed in a more senior-compatible manner in the future.

Nevertheless, the trends in the residential trade and industry will shift mainly in the reverse direction until 2030 with the effect of a growing development of households in most countries. Thus, there is an increasing tendency towards higher real estate demands (Cecodhas, 2012; United Nations, 2001). As a result of the strong demographic movements, household sizes as well as the average number of persons per household is also changing. While in the past decades there was a predominant share of 3-and-more-person households, today there is a trend towards smaller 1- and 2-person households ranging from 45% in Romania to 73% in Germany, which represents an increased demand for such habitations in the future (Cecodhas, 2012; Ministry of the Interior and Kingdom Relations, 2010; United Nations, 1974). Real estate prices have increased over the last few decades. The total housing costs in the Purchasing Power Standard ranged from a relatively low level of 138.4 in Romania to a high level in Germany at 771.5 (Cecodhas, 2012). Furthermore, also the construction cost index increased from 2005 to 2010, especially with high movements in Bulgaria, Latvia, Romania and Spain (Cecodhas, 2012). These dimensions could inhibit the realisation of custom-made housing, if these trends also develop in future.

The economic conditions differ between the researched countries, although they all include a growing tendency of per-capita income (HSBC, 2012). The GDP per capita develops in two different ways: In Estonia, Germany, Hungary, Latvia, Lithuania and Spain the movement will be positive until 2050; the states Bulgaria, Poland, Romania and Slovakia will realise a negative economic shift (European Commission, 2012). If this develops over the coming decades, it could also be a disadvantage for the fulfillment of custom-fit real estate assets.

Decision-making of real estate experts by using the transformed AHP model

As analysed earlier, it is of vital importance to successfully manage the future development of demographics, space as well as environmental social issues to realise the overall target of an ideal real estate portfolio for the year 2050. In the transformed macroeconomic AHP model, the demographic criterion reflects the development of the individuals, demographic alterations of populations as well as changes in the real estate stocks. This criterion embraces sub-criteria such as clusters of generations and housing stock characteristics. The space criterion focuses on building equipment and the building lifecycles with sub-criteria, e.g., build quality and average number of rooms per dwelling. The third criterion of environmental social features covers real estate environments, price conditions and economic situations of individuals and states with sub-criteria such as income level and supply/ demand. The alternatives to reach the overall target are the extrapolated version that includes the current portfolio of each country and the forecast for future years, in which just the planned routine repairs and maintenance will be realised in order to achieve the lifecycle of the assets. A significant strength are no additional

homemade leverages and stable level of rents. A weakness is the absence of customised dwellings. The modernised version also refers to the current dwelling stock with an extrapolation of the age distributions to future years, but also include a strong focus on restructuring and modernisation of dwellings and home components where customised residences are necessary, such as the need for senior-compatible living conditions. An advantage is the realisation of custom-fit components; nevertheless, this option entails additional modernisation fees to finance the rebuilding and modernisations. New-construction real estate portfolios are newly constructed housing stocks where there is a demand for customised dwellings. An opportunity could be the advancement of real estate assets with the risk of an unpayability of residences because of high investments and level of rents.

13 experts were chosen to realise the pairwise comparisons of the levels of the created AHP hierarchy. These experts were clustered into the following groups: Academics with a special knowledge of international economics and business, practical professionals in the residential trade and industry, researchers and consultants of residential trade and industry branch alliances, and representatives and researchers for a particular real estate country market. The consistency ratio of the pairwise comparisons of the experts lies between 0.0% and < 5.0% for the matrices with a rank of 3 variables, and between 0.0% and < 10.0% for the matrices with 5 and 7 variables; therefore, the consistency is satisfactory according to Saaty (1990). The interview results validate the trends and future prognoses of the statistics mentioned before. The outcomes prove that there is a strong requirement to shift to additional custom-fit residences by 2050. Regarding the interviewees the habitations at present do not correspond to the future transformations of demographics, space and environmental social features. Comparable the statistics also the experts forecast vital variations that cause developments such as modernisations and new constructions. Therefore, the share of extrapolated real estates in 2050 is at a low level. The modernised version as well as the new construction option of the 2050 portfolio mix demonstrate much higher shares in the analysed countries. In total the ratios of modernised and new construction versions comprise between a minimum quotation of 74.2% in Spain as well as a maximum percentage of 82.3% in Bulgaria, which demonstrates a central necessity of advancement of the actual real estate assets to stabilise and develop these properties also in future years and to meet the demands of the changing populations.

Conclusions

There are different analyses in this case study. The first secondary analyses are based on statistical databases from various studies and evaluate in detail past and future economic trends from around 1970 to 2050 that are significant for the development of the residential trade and industry. The main aspects such as transformations of population structures and increase of smaller households demonstrate a high necessity to safeguard assets in future to correspond to the requirements of occupants, which are also high on the agenda of political and branch alliance federations. With Saaty's AHP methodology an innovative model to forecast future portfolios is generated to respond to the complex needs of the international real estate economy. The carried-out branch specialist interviews results reflect in accordance to the statistical databases the need of development until 2050 with the outcome of essential shifts and high shares of modernised and newly constructed real estate assets in 2050 in all analysed 10 countries.

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Pattern recognition applied to chart analysis. Evidence from intraday international stock markets

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Abstract

Technical analysis as sophisticated form of forecasting technique joins different popularity in the academic and business world. In the past technical trading rules and their performance were seen skeptical. This is substantiated by the acceptance of the efficient market hypothesis and mixed empirical findings about technical analysis in widely cited studies.

The flag pattern is seen as one of the most significant spread chart patterns among the stock market charting analysts. The present research validates a trading rule based on the further development of flag pattern recognition. The research question concentrates on whether technical analysis applying the flag pattern can outperform an index focusing international stock markets. The markets observed are represented by the corresponding indices DAX (Germany), S&P and DJIA (United States) and IBEX (Spain).

The design of the trading rule presents several changes with respect to previous academic works: The wide sample used when considering intra-day data together with the configuration of some of the variables and the consideration of risk allows concluding that the trading rule provides greater positive risk-adjusted returns than the buy and holding strategy which is used as benchmark. The reported positive results strengthen the robustness of the conclusions reached by other researchers.

Keywords: *trading rule, pattern recognition, technical analysis, bull flag.*

Introduction

Chart pattern studies examine the forecasting probability of visual chart patterns commonly used by technical analysis. In the academic literature different markets are analyzed with pattern recognition, e.g. stock markets and foreign exchange markets. Besides varying markets to be analyzed, pattern recognition and the profitability of pattern recognition differ depending on the methodology applied.

An example of a rigorous study of chart pattern is Chang and Osler's (1999). Chang and Osler analyzed six foreign exchange markets using daily spot rates evaluating the perfor- mance of head-and-shoulders patterns from 1973-1994. They program an algorithm for head-and-shoulders identification and implement a buy-and-hold strategy. The study shows in case of all six foreign exchange rates that simple technical trading rules generate substan- tially higher returns than the head-and-shoulders rules.

Lo et al. (2000) test the usefulness of 10 chart patterns on a large number of NYSE/AMEX and NASDAQ (Nasdaq Composite Index) stocks from 1962-1996. Applying smoothing techniques such as nonparametric kernel regression, their methods suggest that technical analysis can be improved by using automated algorithms. Further they detected that tradi- tional patterns such as head-and-shoulders and rectangles do not have to be optimal. Lo et al. obtain positive results and conclude that technical analysis can add value to the invest- ment process.

Caginalp and Laurent (1998) provide a study about S&P 500 stocks over 1992-1996. The found out that candlestick reversal patterns generate substantial profits in stock markets compared to a buy-and-hold strategy.

Leigh, Modani et al. (2002) and Leigh, Paz et al. (2002) illustrate that bull flag patterns generate positive excess returns (before transaction costs) for the NYSE Composite Index over a buy-and-hold strategy while. Leigh, Modani et al. (2002), Leigh, Paz et al. (2002) Leigh, Purvis et al. (2002) and Wang and Chan (2007) all implement a variation of the bull flag stock chart using a template matching technique based on pattern recognition.

Leigh, Paz et al. (2002) test the bull flag charting heuristic for trading the NYSE Composite Index for 4,817 trading days in a test period from 1980-1999 applying various time hori- zons. Statistical results fail to confirm the null hypothesis that the markets are efficient respectively to the weak form of the efficient markets hypothesis. The results are supplied for a long time period. Thus, parameter optimization and out-of-sample tests are conducted and data snooping problems addressed.

Leigh, Purvis et al. (2002) conduct four experiments combining pattern recognition, neural network, and genetic algorithm techniques to forecast price changes for the NYSE Compo- site Index. The first experiment focuses on recognizing the bull flag with pattern recognition and underlies the same methodology as in Leigh, Paz et al. (2002). Within their exper- iments Leigh, Purvis et al. detect the decision support potential of the new soft computing tools respectively the application of multiple tools and the power in multiple classifier sys- tems. The results of their work support the effectiveness of the technical analysis approach through use of the bull flag price and volume pattern heuristic.

Wang and Chan (2007) analyze the potential profit of bull flag technical trading rules for the NASDAQ and the TWI (Taiwan Weighted Index). They use a template matching tech- nique based on pattern recognition and obtain positive results: All technical trading rules correctly predict the direction of changes in the NASDAQ and TWI. These studies show that charting patterns can predict stock prices.

There are also studies which obtain negative results with regard to the profitability of pat- tern recognition as Curcio et al. (1997), Guillaume (2000) and Lucke (2003) which focus on foreign exchange markets.

To summarize, the success of pattern recognition techniques is strongly dependent on mar- kets observed, sample periods tested and patterns applied. Previous studies have shown that the forecasting probability of technical analysis can be improved by conducting parameter optimization, out-of-sample-testing and addressing of data snooping problems.

Hypothesis and goals

The present research builds on empirical findings of previous research following the objective to prove that flag pattern recognition is a profitable forecasting method for different international stock markets. This objective will be achieved mainly by quantitative research, supplemented by a qualitative literature review.

In the course of qualitative investigations, previous technical analysis studies will be examined. This theory-driven part should serve as overview of today's reputation of technical trading strategies pointing out whether technical trading rules are able to outperform a chosen benchmark. In this sense, a research gap will be identified which is to be closed within the practical part of the research.

The practical part will be implemented by quantitative research. In the foreground is the further development and optimization of existing pattern recognition methods with regard to the flag pattern. Thus, returns provided by trading rules based on pattern recognition will be analyzed in depth. Some

relevant changes will be realized in a way that the results, analyzed as a whole, allow to validate the flag pattern in a more consistent and robust way.

Methodology

The introductory part of the present research project is descriptive since an analysis of previous research will be done to get an overview about studies done so far in this area. The focus will be set on the profitability of pattern recognition on stock markets. The general idea is to find out in which direction the trend goes. A systematic literature review of analyzed studies will be created and relevant criteria implemented.

The practical part of the work is quantitative. It concentrates on pattern recognition applying the bull flag template for figuring out buy and sell signals. Inspired by previous publications of Leigh, Modani et al. (2002), Leigh, Paz et al. (2002), Leigh, Purvis et al. (2002) and Wang and Chan (2007) a 10x10 grid matrix with weights ranging from -5 to 0 will be implement. Since the selection of weights within this matrix is essential, an alternative definition of weights and an alternative grid matrix are proposed. Further the matrix contains an IF-THEN rule what differs from academic research in this area done before.

In a next step the trading rule specification is implemented. Based on daily and intraday returns for the DAX, S&P, DJIA and IBEX statistical analysis will be performed and algorithms programmed to forecast future markets prices on these stock markets. The focus will be on the bullish and the bearish flag likewise taking into consideration an important modification of the bullish flag. Further, not only daily returns, but also HFT will be considered and not only closing prices, but also the body of each candlestick will be taken into ac- count. Finally, more than 120,000 candlesticks will be included for each index.

Conclusions

All previous chart pattern studies analyzed so far have in common that daily returns are used by the researches. In this context the question arises which return to chose (opening, closing, highest, lowest). Some studies work with candlesticks to include the development of prices within a trading day (e.g. Marshall, Young and Rose (2006), Horton (2009)). The present research goes one step further and analyses intra-day data applying candlesticks. This ensures that a trading day is displayed in a high degree of detail.

When implementing the flag pattern approach, researchers build a 10x10 grid matrix allocating weights into the cells. So far, the idea of the weight allocation is to construct a consolidation phase which is followed by a break out. Following the definition of Downes and Goodman (1998) a more accurate reflection would be achieved by assuming the break out first and the consolidation afterwards. In the present research, this is put into practice by allocating the weights in a different way than done in previous research.

Further, in previous research a lack of dynamic approach can be observed. Therefore the idea is to implement stop loss and take profit thresholds. In this way, the whole approach is IF-THEN rule related which is closer to investor’s behaviour.

The last aspect which is subject to further development is the consideration of risk. In the past the approach was often not risk-adjusted. Mostly it was reasoned in using a broad based market average which made the adjustment for risk of individual securities unnecessary (as Leigh, Modani and

Hightowera (2004)). Some authors conducted out-of-sample- tests (as Charlebois and Sapp (2007)). The present research intends considering the risk component by using the maximum drawdown.

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