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## SECTORAL FUNDAMENTAL ANALYSIS
## ON THE WARSAW STOCK EXCHANGE

### The concept of sector's fundamental strength and its estimation procedure

Fundamental strength is a measure which rationally defines a given company's economic and financial condition. In turn, economic and financial condition is characterized as a resultant of economic and financial indicators defining liquidity, profitability, company debt, management efficiency and market indicators. It is a multidimensional category which cannot be measured directly. The objective measurement of a company's economic and financial condition and the estimation of its fundamental strength are possible only via methods of multidimensional comparative analysis. For this purpose, the concept of synthetic development measure *TMAI* may be used.

The synthetic development measure "*Taxonomic Measure of Attractiveness of Investments*" (*TMAI*) can be estimated with the following formula:

$$TMAI_i = 1 - \frac{d_i}{d_0}, \ (i = 1, 2, ..., n),$$

where:

$TMAI_i$ – synthetic development measure for the *i-th* object,

$d_i$ – distance between the *i-th* object and the model object defined with the formula:

$$d_i = \sqrt{\sum_{j=1}^{k}(z_{ij} - \max_j(z_{ij}))^2}, \ (i = 1, 2, ..., n), (j = 1, 2, ..., k),$$

$n$ – number of objects,

$k$ – number of variables,

$d_0$ – norm which assures that $TMAI_i$ values belong to the interval from 0 to 1:

$$d_0 = \bar{d} + a \cdot S_d.$$

According to relation (1) and given $0 \le TMAI_i \le 1$ and $d_i > 0$, we may find the marginal value for *a* constant:

$$a \geq \frac{d_{imax} - \overline{q}}{S_d},$$

where $d_{imax}$ is the maximum $d_i$ value, $S_d$ is the standard deviation for $d_i$.

In this method, a system of data standardisation was used to assure its comparability: the 0-1 standardisation. We calculated $z_{ij}$ using the following formula:

$$z_{ij} = \frac{x_{ij} - \overline{x}_j}{S_j},$$

where:

$x_{ij}$ – values of the *j-th* variable for the *i-th* object,
$\overline{x}_j$ – average value of the *j-th* variable,
$S_j$ – standard deviation for the *j-th* variable.

The *TMAI* ratio is standardised and reaches values ranging from 0 to 1. The closer the value of the measure to 1, the better the object in terms of the general criterion (in this research: economic and financial standing).

In order to calculate *TMAI* for nonfinancial companies listed on the Warsaw Stock Exchange, the following variables have been used:

    – profitability ratios:

$$return\ on\ equity\ (ROE) = \frac{net\ profit}{average\ value\ of\ equity},$$

$$return\ on\ assets\ (ROA) = \frac{net\ profit}{average\ value\ of\ assets},$$

$$net\ profit\ margin = \frac{net\ profit}{net\ revenues\ form\ sales},$$

    – liquidity ratio:

$$current\ liquidity\ ratio = \frac{current\ assets}{current\ liabilites},$$

    – activity ratios (management efficiency):

$$amount\ due\ turnover\ (in\ days) = \frac{average\ number\ of\ receivables}{net\ sales} \cdot number\ of\ days,$$

$$inventory\ turnover\ (in\ days) = \frac{average\ value\ of\ inventory}{cost\ of\ goods\ sold} \cdot number\ of\ days,$$

$$liabilities\ turnover\ (in\ days) = \frac{average\ value\ of\ current\ liabilities}{cost\ of\ goods\ sold} \cdot number\ of\ days,$$

$$assets\ turnover = \frac{net\ sales}{total\ assets},$$

– debt ratio:

$$debt\ margin = \frac{total\ liabilites}{total\ assets},$$

– market indicators:

$$net\ book\ value\ per\ share = \frac{shareholders\ equity}{numbers\ of\ share},$$

$$net\ earnings\ per\ share\ (EPS) = \frac{net\ profit}{numbers\ of\ share}.$$

Those variables are generally available and published, for instance by *Notoria Serwis*, for every quarter and for the year for all the companies, which should make it easy to carry out the analyses proposed in this paper in terms of data access.

Among the variables presented above amount due turnover, inventory turnover, and liabilities turnover and the debt margin have been considered to be destimulants. The current liquidity ratio is a nominate, while all the other variables have been assumed as stimulants.

A proposal is made to define the sector's fundamental strength through a procedure of estimating the *TMAI* value for companies belonging to the sector. The next step is to calculate the arithmetic mean of the *TMAI* value or, given a large interval (difference between the maximal and minimal value), the *TMAI* value's median value for a specific sector. The mean value of *TMAI* determines the sector's fundamental strength.

**A profile of studied sectors and timespan**

The empirical study was focused on the most important nonfinancial sectors comprising a relatively large number of companies listed on the Warsaw Stock Exchange, namely companies representing the construction, trade, services and industry sectors. Table 1 presents the structure of the sectors studied and the number of companies listed under each sector in the years under research.

Companies and sectors under study

| Sectors | Number of companies | | | | | |
|---|---|---|---|---|---|---|
| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
| Construction | 11 | 12 | 14 | 15 | 17 | 16 |
| Trade | 9 | 14 | 15 | 15 | 16 | 12 |
| Services | 22 | 29 | 38 | 33 | 34 | 32 |
| Industry | 68 | 77 | 88 | 98 | 93 | 101 |
| Total | 110 | 132 | 155 | 161 | 160 | 161 |

Source: own study.

The research comprises the timespan from 2005 to 2010 for all Warsaw Stock Exchange companies, on which all data enabling the calculation of *TMAI* were available. This helped us to monitor the attractiveness of the sectors under study in the bull period (2005–2007 and 2009–2010) and bear period initiated by the 2007–2008 crisis.

**Analysis of fundamental strength in the sectors in 2005–2010**

In figures 1–4, *TMAI* values have been presented for the sectors under study in 2005–2010. Each figure shows two variants of *TMAI*: *TMAI* as the average value for companies belonging to the sector in a given year and *TMAI* as the median. The analysis of the graphs leads us to claim that there are no significant differences between the mean and the median values. This proves the measure's stability in each of the years studied.

Figure 5 shows the fluctuations of *TMAI* throughout the 2005–2010 time period in the mean value variant. In 2005, the most attractive sector, as far as fundamental strength is concerned, was the services sector, while the least attractive one was the construction sector. The situation changed completely in 2006, when the services sector was the weakest and the industry sector marked the best results. The boom (bull market) on the Warsaw Stock Exchange in years 2006–2008 was a period of growth in fundamental strength in all sectors. Services were again the leader, but construction was not much weaker. In this period, the lowest values were marked by the trade sector, which noted the smallest growth in the level of attractiveness in 2006–2008. In Poland, the 2009 crisis strongly hit the services sector, which marked the largest drop in the level of attractiveness. In 2010, the same sector proved best in quick recovery from the 2007–2008 crisis. The slowest sectors to recover from the crisis were construction and industry. This confirms the thesis which states that the sectors' fundamental attractiveness is most flexible in the services sector (high risk of investment) and least flexible in construction and industry. The measure of sectors' fundamental strength applied confirms the essential relationship between economy and stock exchange, because the sectors' economic and financial condition finds its reflection in the fluctuations of stock indices that have analogical periods of growth and slump as the *TMAI* measure.
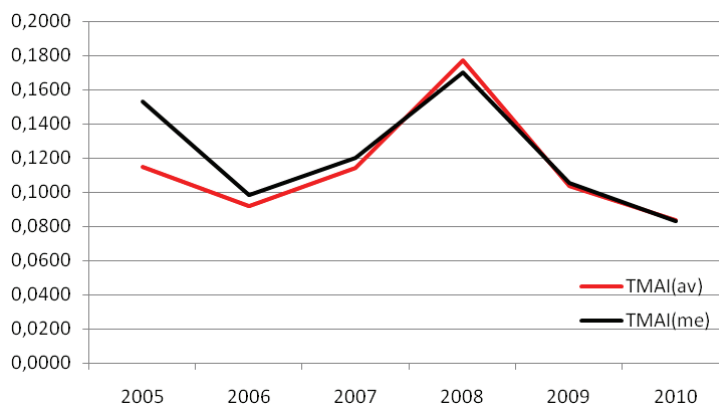
Figure 1.   *TMAI* values for the construction sector



Figure 2.   *TMAI* values for the trade sector
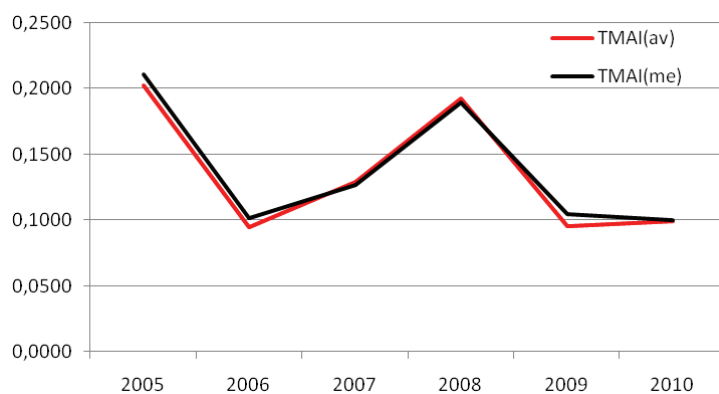


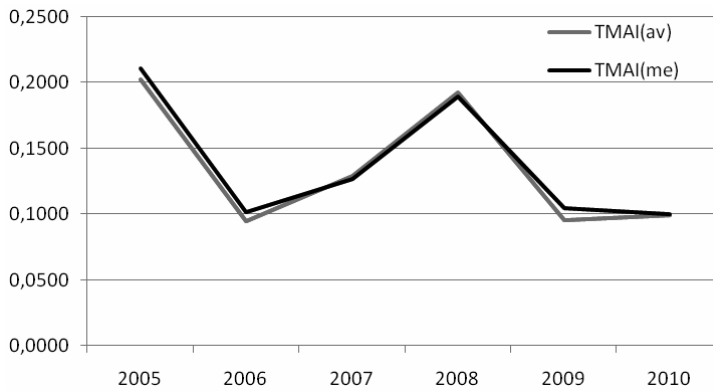Figure 3.   *TMAI* values for the services sector

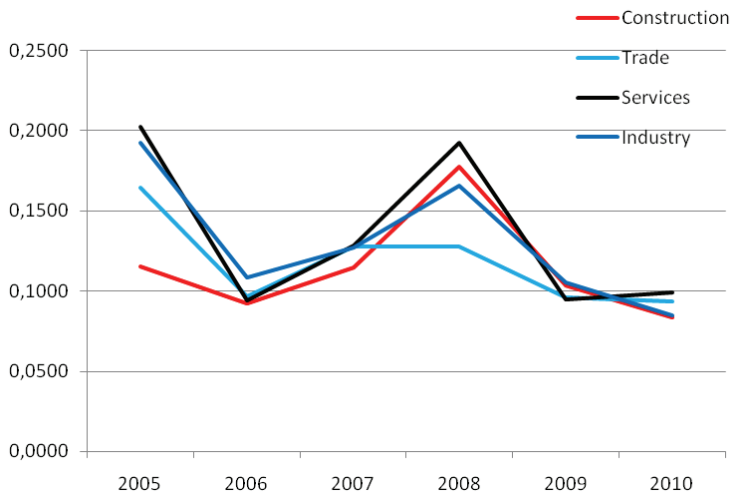Figure 4.   *TMAI* values for the industry sector.



Figure 5.   Changes in *TMAI* values for the sectors studied.

Owing to the fact that the sectors' fundamental strength *TMAI* measure values belong to the interval from 0 to 1, it may be said that the fundamental strength of the sectors studied is not very notable, which increases the risk of investing in such sectors.

**Measure of the general economic situation (*GES*) and general business tendency (*GBT*)**

Research on the business tendency is carried out with the help of two main groups of study methods. The first group is composed of business tendency indicator methods, the second – business tendency test methods. Business tendency indicators are based on the observation of fundamental economic values' dynamics. They are usually estimated with the application of the geometric mean of fixed base indices for the defined values. But it is mostly surveys addressed to a group of experts (mainly economic practitioners, such as company managers) containing questions referring to basic economic values that are the elementary research tool within the business tendency test methods.

In Poland, studies with the application of the business tendency test based on monthly or quarterly data are systematically conducted by the Central Statistical Office (GUS). Studies are carried out separately for each branch: industry (since 1992), construction, trade, services (since 1993) and investment in industry and construction. Relevant indices are then calculated using the data, weighed by:
- the value of sold industry production in current prices (industry),
- the value of sold construction and assembly production in current prices (construction),
- the value of retail sale in current prices (trade),
- revenues from sold products, goods and materials in current prices (services).

These indices represent numerical values belonging to the interval from –100 to +100. Positive values of a given index signify a boom, while negative ones – a downturn.

The article refers to monthly general economic situation indicators and general economic climate indicators in the sectors under study. Owing to the fact that the indices published by the Central Statistical Office belong to the interval (–100, 100), the geometrical mean value has been applied to estimate the yearly index for normalized Central Statistical Office indicators.

Normalization was carried out with the use of unitarization:

$$z_i = \frac{x_i - \min(x_{ij})}{\max(x_{ij}) - \min(x_{ij})} = \frac{x_i - (-100)}{100 - (-100)} = \frac{x_i + 100}{200}.$$

**Comparison *TMAI* with *GES* and *GBT***

Table 2 comprises *TMAI* (average level), *GES* and *GBT* for the sectors under study in the 2005–2010 timespan.

Table 2

*TMAI*, *GES* and *GBT* values for the sectors under study in the 2005–2010 timespan

| Years | TMAI(av) | GES | GBT |
|---|---|---|---|
| Construction | | | |
| 2005 | 0,1151 | 0,5177 | 0,5512 |
| 2006 | 0,0922 | 0,5634 | 0,5974 |
| 2007 | 0,1146 | 0,5892 | 0,6186 |
| 2008 | 0,1774 | 0,5545 | 0,5819 |
| 2009 | 0,1036 | 0,4171 | 0,4288 |
| 2010 | 0,0837 | 0,4366 | 0,4747 |
| Trade | | | |
| 2005 | 0,1646 | 0,4614 | 0,4668 |
| 2006 | 0,0968 | 0,4793 | 0,4796 |
| 2007 | 0,1282 | 0,5448 | 0,5380 |
| 2008 | 0,1278 | 0,5441 | 0,5319 |
| 2009 | 0,0963 | 0,5175 | 0,4841 |
| 2010 | 0,0937 | 0,5104 | 0,5052 |
| Services | | | |
| 2005 | 0,2025 | 0,9460 | 0,9118 |
| 2006 | 0,0943 | 0,6150 | 0,5976 |
| 2007 | 0,1287 | 0,6450 | 0,6383 |
| 2008 | 0,1924 | 0,6960 | 0,7061 |
| 2009 | 0,0948 | 0,5590 | 0,5504 |
| 2010 | 0,0993 | 0,5340 | 0,5477 |
| Industry | | | |
| 2005 | 0,1924 | 0,5324 | 0,5514 |
| 2006 | 0,1084 | 0,5575 | 0,5751 |
| 2007 | 0,1275 | 0,6250 | 0,6085 |
| 2008 | 0,1660 | 0,5780 | 0,5623 |
| 2009 | 0,1054 | 0,4633 | 0,4709 |
| 2010 | 0,0850 | 0,4995 | 0,5265 |

Source: own calculations.

Figures 6–11 present the changes of *GES* and *GBT* in years 2005–2010 for the sectors under study (separately and together). The data analysis shows that both measures react analogically to the situation on the market. All sectors, excluding the services sector, noted a rise in *GES* and *GBT* in periods 2005–2007 and 2009–2010 as well as a decline in the 2008–2009 crisis. The sectors' fundamental strength measured by *TMAI* in all studied sectors rose in years 2006–2008 and fell in years 2005–2006 and 2008–2010.
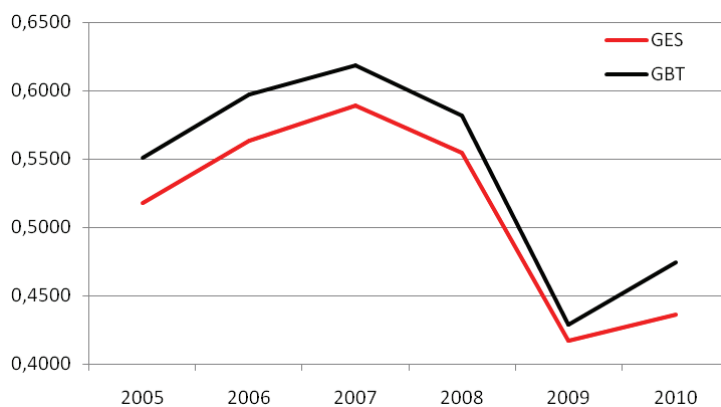
Figure 6.  *GES* and *GBT* values for the construction sector



Figure 7.  *GES* and *GBT* values for the trade sector



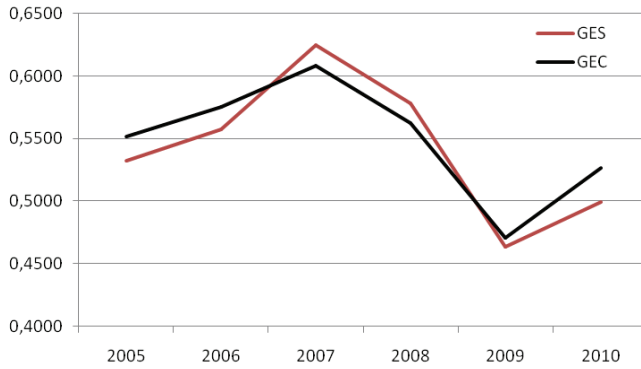Figure 8.  *GES* and *GBT* values for the services sector

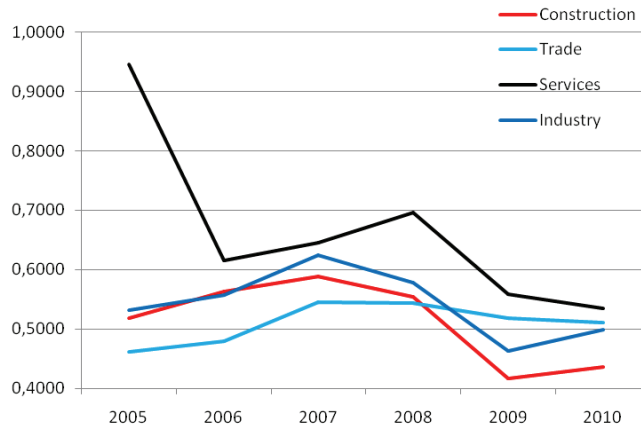Figure 9.  *GES* and *GBT* values for the industry sector
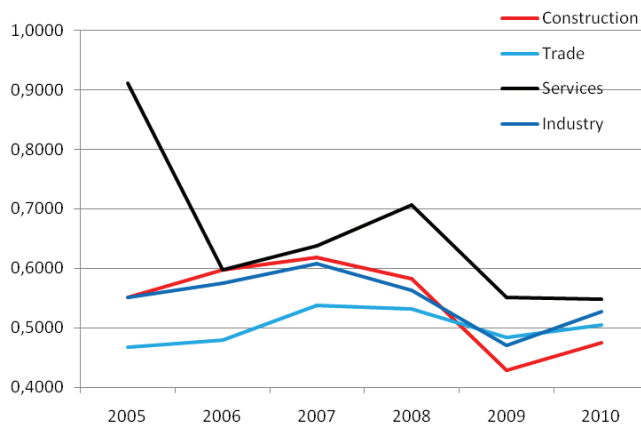


Figure 10. *GES* values for all sectors



Figure 11.  *GBT* values for all sectors

The services sector's business tendency was consistent with the fluctuations of the sector's fundamental strength measured by *TMAI*. It may be thus said that the business tendency measured by *GES* and *GBT* in the period under study exceeded real economy, the condition of which was measured by the fundamental strength of *TMAI* in the sectors. On the other hand, the sectors' fundamental strength, arising from the economic and financial situation of companies forming the sector ran along similar lines as the market tendency measured with the Warsaw Stock Exchange market indicators *WIG* and *WIG20*. In view of the business tendency measured by *GES*, the sequence of sectors according to their attractiveness in 2010 is as follows: services, trade, industry, construction (as for *GBT*, industry is ahead of trade). The same sequence is valid for the sectors' fundamental strength.

Table 3 shows coefficients of correlation between *TMAI*, *GES* and *GBT* in the sectors under study in 2005–2010.

Table 3

Correlation coefficients for the measures studied

| **Construction** | *TMAI(av)* | *TMAI(me)* | *GES* | *GBT* |
|---|---|---|---|---|
| *TMAI(av)* | 1 | | | |
| *TMAI(me)* | **0,8885** | 1 | | |
| *GES* | 0,4157 | 0,4499 | 1 | |
| *GBT* | 0,3699 | 0,4165 | **0,9933** | 1 |
| **Trade** | *TMAI(av)* | *TMAI(me)* | *GES* | *GBT* |
| *TMAI(av)* | 1 | | | |
| *TMAI(me)* | **0,9852** | 1 | | |
| *GES* | −0,2335 | −0,3481 | 1 | |
| GBT | −0,0489 | −0,1660 | **0,9184** | 1 |
| **Services** | *TMAI(av)* | *TMAI(me)* | *GES* | *GBT* |
| *TMAI(av)* | 1 | | | |
| *TMAI(me)* | **0,9937** | 1 | | |
| *GES* | **0,8563** | **0,8951** | 1 | |
| *GBT* | **0,8966** | **0,9275** | 0,9957 | 1 |
| **Industry** | *TMAI(av)* | *TMAI(me)* | *GES* | *GBT* |
| *TMAI(av)* | 1 | | | |
| *TMAI(me)* | **0,9968** | 1 | | |
| *GES* | 0,3422 | 0,3362 | 1 | |
| *GBT* | 0,2985 | 0,2831 | **0,9568** | 1 |

Source: own calculations.

The data presented in Table 3 reveals that an important correlation between measures of business tendency (*GES* and *GBT*) and the sector's fundamental strength (*TMAI*) occurred for services, while a dependency of medium importance occurred for the con-

struction sector. A non-important correlation was present for trade (negative) and industry (positive).

## Conclusion

On the basis of the analysis, it may be concluded that the proposed procedure of estimating fundamental strength of sectors on the stock exchange could prove to be an interesting tool which minimizes the risk of investment and increases the effectiveness of investing on the stock exchange.

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**Summary**

The article presents a study of sectoral fundamental strength based on companies listed on the Warsaw Stock Exchange. The authors employed selected methods of fundamental analysis in connection with sector assessment in view of economic and financial indicators chosen from among the group: liquidity, profitability, company debt, management efficiency and market indicators. For sectors identified at the Warsaw Stock Exchange, the *TMAI* synthetic measure of development was calculated in order to draw up sector ratings and to define their attractiveness. Then, changes occurring in the time period under study were examined. The proposed procedure allows for the evaluation of individual sectors from the point of view of attractiveness for stock investors. It was also examined how the condition of the sectors studied influences the economy's condition and the recent years' crises.

The study made use of economic and financial data, retrieved from *Notoria Serwis*, regarding companies included in individual sectors. The studies focused on the period from 2005 to 2010. This helped to monitor the change in the attractiveness of particular sectors over time in the periods of both bull market and bear market caused by the 2007–2009 crisis.

## SEKTOROWA ANALIZA FUNDAMENTALNA
## NA GIEŁDZIE PAPIERÓW WARTOŚCIOWYCH W WARSZAWIE

**Streszczenie**

W artykule zaprezentowano badanie fundamentalnej siły sektorów dla spółek notowanych na Giełdzie Papierów Wartościowych w Warszawie. Wykorzystane zostały wybrane metody analizy fundamentalnej związane z oceną sektorów przez pryzmat wybranych wskaźników ekonomiczno-finansowych z grupy: płynność, rentowność, zadłużenie, sprawność zarządzania oraz wskaźniki rynkowe. Dla sektorów występujących na Giełdzie Papierów Wartościowych w Warszawie wyznaczono syntetyczny miernik rozwoju *TMAI* pozwalający zbudować rating sektorów i określić ich atrakcyjność.

Oceniono zmiany, jakie występują w latach objętych badaniem. Proponowana procedura umożliwia ocenę poszczególnych sektorów z punktu widzeniach ich atrakcyjności dla inwestorów giełdowych. Oceniono wpływ kondycji badanych sektorów na kondycję gospodarki i kryzysy ostatnich lat.

Do przeprowadzenia badań wykorzystano dane ekonomiczno-finansowe dla spółek tworzących poszczególne sektory pochodzące z *Notoria Serwis*. Badaniami objęto lata 2005–2010. Umożliwiło to śledzenie zmian atrakcyjności poszczególnych sektorów w czasie zarówno w okresie hossy jak i bessy wywołanej kryzysem lat 2007–2009.