# Returns on performance measure-based investment fund selection strategies in Poland, 2002—2011

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## 1. Introduction

Investment funds play a key role in saving and investment decisions of households and have a potential to increase funds available for both current consumption and retirement. Given the large number of funds available on the market their selection becomes a major problem. This process is even more difficult due to frequently high costs associated with these investments.

Over the years, various measures have been introduced to assess fund performance. They range from simple return comparisons to reward-risk ratios and model-based measures. Reward-risk ratios are obtained typically by dividing a statistic of a fund return measure by a measure of risk. Model-based measures estimate outperformance of some selected benchmark portfolios by a fund. Among reward-risk ratios the Sharpe ratio [Sharpe, 1994] uses average excess returns and measures risk by their standard deviation. Although widely used it is subject to criticism in the literature and some additional ratios and measures have been proposed [Goetzmann et al., 2007]. An important class of risk measures in investment and portfolio selection are drawdown measures, e.g. the maximum drawdown (MDD), which is widely used in investment practice due to its intuitive appeal. There have also been attempts at their incorporation into portfolio management research [Alexander and Baptista, 2006]. A performance ratio based on MDD has also been proposed and shown recently to exhibit some features similar to manipulation-proof performance measures [Bali et al., 2012].

The objective of this note is to find out if some simple performance measures can be useful in the actual fund selection decision. The research is based on a sample of investment funds in Poland from the recent years and covers both major bull and bear market periods.

## 2. Data and methods

Our research covers the data from the years 2001–2011. The fund sample is based on two sources. First, balanced, active allocation and broad market equity (i.e. non-specialized equity) investment funds active at the end of 2011 with the minimum one-year history are selected from the fund database on the mojefundusze.pl website. Second, same criteria are used to select absolute return closed-end funds investing in the Polish market from the fund database on the fundusze.wp.pl website. The final sample combines these two sets and contains prices for 64 funds. Central bank reference rate obtained from the National Bank of Poland website is taken as the risk-free rate. If there was a change in the reference rate during a year the annual rate is obtained by time-weighting the rates. The WIG20 index prices are obtained from stooq.pl website. 2001 data are used to select funds for 2002 in the investment strategies we investigate. There are 414 fund-year observations in the sample in the 2001–2011 period and 394 observations in the 2002–2011 period. The number of funds in the sample in individual years is presented in Table 3.

Four performance measures are used: the annual return, the nadve ratio, the MDD ratio and the Sharpe ratio. They are computed in the following way. The annual return is the annual return for a fund in a given year based on its price. The nadve ratio is a reward-risk ratio obtained by dividing the annual excess return, i.e. the annual return minus the risk-free rate, by the annualized standard deviation of fund returns in a given year. The MDD ratio (the original term for this ratio is the Calmar ratio, see [Bali et al., 2012]) is a risk-reward ratio based on the maximum drawdown (MDD) of the fund price in a given year and is obtained as follows First MDD for a given year is obtained from the fund prices as a maximum difference between the current maximum share price and the following minimum in the given year computed as a return rate. Then the annual excess return is divided by the MDD in the given year. Finally, the Sharpe ratio [Sharpe, 1994] for a given year for a particular fund is computed as the annualized ratio of the average monthly or quarterly excess returns in that year and their standard deviation.

We apply these four measures to investigate the results of several investment fund selection strategies in the Polish fund market in the ten-year period from 2002 to 2011. This is done in the following way.

First, we compute the results from two simple strategies, A and B, each based on the one of the four performance measures described above: 1—the annual return, 2—the nadve ratio, 3—the MDD ratio and 4—the Sharpe ratio. Strategy A works as follows: we select the top fund based on a ranking from year t–1 according to a performance measure and invest all assets into this fund in the year t. At the end of year t we rank funds in the same way. If there is a change in the top fund we reinvest funds for the year t+1 in the new top fund. Strategy B works in the same way except that we invest into the equally weighted portfolio of the top three funds in the ranking. Strategy A1 is the strategy A based on the performance measure 1, i.e. the annual return, strat-

egy B1 is the strategy B based on performance measure 1, strategy A2 is the strategy A based on the performance measure 2, i.e. the nadve ratio and so on.

At the end of the ten-year period we record the compound rates of return, average annual rates of return as well as their standard deviation, and compound rates of return applying 2% front load expense from the eight A and B strategies. We include 2% front-end sales load at the beginning of each period if we were not invested in a fund in the previous period. The management fee is included in the fund prices. Taxes are not included in the computations.

For comparison we include rates of return from the strategies C and D, which are the same as A and B except they involve perfect foresight, i.e. strategy C is based on the returns from the top fund each year and strategy D on the equally-weighted portfolio of the top three funds ranked on one of four performance measures. These rates are calculated to show top returns that would have been available with perfect foresight as well as their risk.

Two other rates are given for reference: first, the returns on a benchmark WIG20 index of the Polish equity market and, second, the returns on equally-weighted portfolio of all funds in our sample in a given year, with and without 2% front-end sales load on the portfolio.

## 3. Results and discussion

The results for the investment fund selection strategies for the full ten-year period 2002–2011 are presented in Table 1.

Based on the compound returns with front-end loads the best three strategies are A1, A3 and B3. Their ten-year rates of return are about 267, 210 and 199%, respectively. A1 is the simplest strategy of investing into the fund with the highest rate of return in the previous year, A3 and B3 are strategies of investing, respectively, into the top or the top three funds based on the MDD ratio ranking for the previous year. The A3 strategy has the lowest risk as measured by the standard deviation of annual returns in this period of 16% compared with 20.36% for B3 and about 22% for A1. It can be seen that the strategies based on the MDD ratio, which is higher for the lower intra-year drawdown funds, i.e. funds with lower intra-year risk of loss exhibit the most attractive reward-risk profiles in our exercise. It is notable that the Sharpe ratio based strategies perform worse than other strategies.

In turn, the equally weighted portfolio of all funds performs worse than A4 and B4 strategies and exhibits higher standard deviation. The no-load return on WIG20 is even lower than the no-load return on this all-fund strategy and exhibits standard deviation higher than all other strategies.

Obviously the perfect foresight strategies C and D fare much better with somewhat higher risk, the results showing that the best funds in a previous year are lagging the best funds in the next period.

Table 2 shows the annual returns on all strategies and on the WIG20 index for the individual years 2002–2011 and allows to analyze the sources of performance differences between strategies in more detail.

The returns on strategy C1 are the maximum returns available in the sample. We can see that in only three years A-strategies select the best fund: in 2005 these are the strategies A1 and A2 and, in 2007, A1 and A3, and all A-strategies in 2008. The correct prediction of the best fund in 2008 is particularly beneficial to the overall result. All strategies select poorly in 2011, where, except B3, they provide negative returns compared to a high positive return of the best fund. Coming at the end of the ten-year period these negative returns decrease considerably the overall strategy performance.

Table 2 shows further that the four performance measures select the same best fund in four out of ten years we investigate. Measures 1 and 2 select the same top fund in eight years, and the measures 3 and 4 in seven years. The large overall difference between A1 and A2 strategies is due to difference in 2002 and 2007 and between A3 and A4 to difference in 2007, 2010 and 2011.

Descriptive statistics for the four performance measures are provided in Table 3, both for the whole period and for the individual years. The overall average annual fund return over the sample period 2001–2011 is 6.17%. The sample average Sharpe ratio is 0.1134 and the MDD ratio average is 0.96. All measures exhibit large standard deviations.

As frequently happens in fund research the results may suffer from the survivorship bias, since some funds active in an earlier year may have ceased to exist and their results are not included in our data. Since usually poorer performing funds are discontinued the bias may be relevant more to the sample statistics than to the results of strategies selecting the best performers. Another arbitrary element of the calculations is the 2% front-end sales load. Such load was assumed to provide some insight for the overall load impact on the returns available over a longer period of investments. In fact in some cases it may be even higher e.g. 4%. It must also be noted that since closed-end funds are among the funds selected in our strategies there may be some practical limitations in their actual implementation since these funds may either be closed to new investors at some periods or open only to investors with a high minimum investment.

The final compound return on a strategy depends on the sequence of annual rates and on the front-load expenses associated with switching funds. Our analysis shows that large overall differences may be a result of different selection in only a small number of years. Obviously, the later a large negative return occurs during the multi-year investment period the more damaging it is to the overall compound rate.

## 4. Conclusion

We have computed returns on several investment fund selection strategies in Poland in the 2002–2011 period. The strategies were based on four performance measures: the annual return, the nadve ratio, the MDD ratio and the Sharpe ratio. For reference the returns on the WIG20 index and the equally weighted all-fund portfolio were also provided. The results demon-

strate that all four measures frequently select the same funds but that even relatively minor selection differences may have profound impact on multi-year returns. While the performance measures used in the paper are not consistently good at predicting the best funds they nevertheless offer quite meaningful improvement over the reference strategies. Single fund strategies investing into the best-performing fund in the previous period based on annual return and the nadve ratio as well as MDD-based strategies provided the most attractive returns. Still, they seem far from attaining returns available potentially with more accurate prediction of fund performance.

## References

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## Apendix

## Table 1.

**Statistics of returns on the investment fund selection strategies in Poland in the period from 2002 to 2011**

| Strategy | Average annual return | Standard deviation of annual returns | Compound rate of return | Compound rate of return with a 2% front-end load |
|---|---|---|---|---|
| A1 | 17.4647% | 21.9717% | 323.5870% | 267.7267% |
| A2 | 14.4121% | 21.7322% | 226.0702% | 177.4085% |
| A3 | 14.8446% | 15.9989% | 264.7625% | 210.3264% |
| A4 | 10.8539% | 16.6494% | 152.3497% | 106.1881% |
| B1 | 12.2371% | 23.5350% | 151.3267% | 113.8778% |
| B2 | 12.9702% | 19.8822% | 190.0776% | 146.8428% |
| B3 | 15.3189% | 20.3666% | 254.1654% | 199.4071% |
| B4 | 11.1378% | 20.1893% | 144.4359% | 103.8463% |
| C1 | 38.6543% | 25.4569% | 2126.6192% | 1832.9850% |
| C2 | 36.4249% | 22.2805% | 1849.7573% | 1558.7814% |
| C3 | 35.4754% | 25.3838% | 1665.6891% | 1402.1830% |
| C4 | 30.5272% | 23.7597% | 1129.4777% | 904.5728% |
| D1 | 31.1100% | 24.3213% | 1158.8489% | 956.8464% |

| Strategy | Average annual return | Standard deviation of annual returns | Compound rate of return | Compound rate of return with a 2% front-end load |
|---|---|---|---|---|
| D2 | 27.6424% | 26.7574% | 888.1072% | 745.6062% |
| D3 | 26.8098% | 23.9859% | 789.7599% | 657.3348% |
| D4 | 25.9338% | 24.8165% | 702.5262% | 573.8391% |
| WIG20 | 9.8377% | 27.4470% | 77.4732% | – |
| Equally-weighted all-fund portfolio | 10.1375% | 23.2364% | 105.1194% | 67.5975% |

Returns are computed for a sample of balanced, active allocation, and broad-market equity funds as well as absolute return closed-end funds investing in the Polish market. For further details and data sources see the main text.

## Table 2.

**Returns on the investment fund selection strategies in Poland in the individual years from 2002 to 2011**

| Strategy | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 2.44% | 24.31% | 28.00% | 40.23% | 50.77% | 33.25% | −10.25% | 12.01% | 11.87% | −17.97% |
| A2 | −1.34% | 24.31% | 28.00% | 40.23% | 50.77% | 6.50% | −10.25% | 12.01% | 11.87% | −17.97% |
| A3 | 2.03% | 24.31% | 28.00% | 23.06% | 35.04% | 33.25% | −10.25% | 12.01% | 3.11% | −2.11% |
| A4 | 2.03% | 24.31% | 28.00% | 23.06% | 35.04% | 6.50% | −10.25% | 12.01% | 11.87% | −15.27% |
| B1 | 4.23% | 30.65% | 30.17% | 29.19% | 40.72% | 13.71% | −33.17% | 12.92% | 14.73% | −20.79% |
| B2 | 4.27% | 23.34% | 30.17% | 29.19% | 42.98% | 9.56% | −27.71% | 10.98% | 9.08% | −2.15% |
| B3 | 1.00% | 32.55% | 30.17% | 29.19% | 40.72% | 16.10% | −27.71% | 23.12% | 5.57% | 2.48% |
| B4 | 2.11% | 32.55% | 23.13% | 23.71% | 40.72% | 3.91% | −27.71% | 10.20% | 11.34% | −8.59% |
| C1 | 11.71% | 64.83% | 36.67% | 40.23% | 79.29% | 33.25% | −10.25% | 56.93% | 35.71% | 38.17% |
| C2 | 11.71% | 64.83% | 36.67% | 40.23% | 57.00% | 33.25% | −10.25% | 56.93% | 35.71% | 38.17% |
| C3 | 11.71% | 64.83% | 31.11% | 30.53% | 79.29% | 33.25% | −10.25% | 50.16% | 25.94% | 38.17% |
| C4 | 11.71% | 64.83% | 31.11% | 30.53% | 57.00% | 33.25% | −10.25% | 56.93% | 16.53% | 13.62% |
| D1 | 9.08% | 53.55% | 33.88% | 34.33% | 64.60% | 28.33% | −19.28% | 54.44% | 31.28% | 20.89% |
| D2 | 8.62% | 53.55% | 33.88% | 33.17% | 56.98% | 27.40% | −35.37% | 49.20% | 28.10% | 20.89% |
| D3 | 9.07% | 53.55% | 33.88% | 34.33% | 60.12% | 27.40% | −25.91% | 35.02% | 19.74% | 20.89% |
| D4 | 9.07% | 43.77% | 30.99% | 34.33% | 54.31% | 27.40% | −33.01% | 48.89% | 22.70% | 20.89% |
| WIG20 | −2.71% | 33.89% | 24.56% | 35.42% | 23.75% | 5.19% | −48.21% | 33.47% | 14.88% | −21.85% |
| Equally-weighted all-fund portfolio | 2.90% | 29.28% | 19.92% | 21.58% | 35.35% | 8.22% | −39.49% | 28.00% | 13.44% | −17.82% |

Returns are computed for a sample of balanced, active allocation, and broad-market equity funds as well as absolute return closed-end funds investing in the Polish market. For further details and data sources see the main text.

## Table 3.
**Descriptive statistics for the four fund performance measures**

| Performance measure | | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | Average of annual statistics, 2002–2011 | Full sample, 2001–2011 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Annual return | Average | 0.0290 | 0.2928 | 0.1992 | 0.2158 | 0.3535 | 0.0822 | −0.3949 | 0.2800 | 0.1344 | −0.1782 | 0.1014 | 0.0617 |
| | Std dev | 0.0560 | 0.1231 | 0.0725 | 0.0679 | 0.1505 | 0.0750 | 0.1202 | 0.1221 | 0.0786 | 0.1284 | 0.0994 | 0.2535 |
| | Min | −0.1484 | 0.1062 | 0.1060 | 0.0942 | 0.1067 | −0.0120 | −0.6569 | 0.0474 | −0.0706 | −0.4581 | −0.0885 | −0.6569 |
| | Max | 0.1171 | 0.6483 | 0.3667 | 0.4023 | 0.7929 | 0.3325 | −0.1025 | 0.5693 | 0.3571 | 0.3817 | 0.3865 | 0.7929 |
| Naive ratio | Average | −0.2727 | 1.2498 | 0.8792 | 0.8843 | 1.7868 | 0.2039 | −1.9103 | 1.1913 | 0.6152 | −1.2542 | 0.3373 | 0.1171 |
| | Std dev | 0.3462 | 1.0550 | 0.7978 | 0.7908 | 0.7214 | 0.4263 | 0.3093 | 0.5601 | 0.7173 | 0.7513 | 0.6475 | 1.3571 |
| | Min | −1.6320 | 0.1315 | 0.0666 | 0.0584 | 0.1371 | −0.4616 | −2.6425 | 0.0226 | −0.8639 | −2.6408 | −0.7825 | −2.6425 |
| | Max | 0.0308 | 3.8273 | 2.3752 | 3.0005 | 3.0935 | 1.5155 | −0.8018 | 2.4828 | 2.6645 | 1.5119 | 1.9700 | 3.8273 |
| MDD ratio | Average | −0.3874 | 2.3228 | 1.8879 | 2.1031 | 2.0027 | 0.2725 | −0.9810 | 1.5270 | 3.3573 | −0.6918 | 1.1413 | 0.9648 |
| | Std dev | 0.3175 | 1.0326 | 0.8272 | 1.0247 | 1.0189 | 0.5865 | 0.0543 | 1.4790 | 12.0930 | 1.3820 | 1.9816 | 4.9228 |
| | Min | −1.1308 | 0.6339 | 0.4948 | 0.6189 | 0.5327 | −0.4395 | −1.0832 | 0.0497 | −0.8150 | −2.0627 | −0.3201 | −4.3143 |
| | Max | 0.2905 | 4.7735 | 3.8336 | 4.8493 | 6.2684 | 2.4011 | −0.7906 | 10.2586 | 92.6930 | 7.3961 | 13.1973 | 92.6930 |
| Sharpe ratio | Average | −0.2857 | 1.1628 | 1.7891 | 1.3736 | 1.7274 | 0.3688 | −2.4551 | 1.1517 | 0.9863 | −1.7215 | 0.4097 | 0.1134 |
| | Std dev | 0.4045 | 0.3200 | 0.5258 | 0.4904 | 0.4292 | 0.3923 | 0.5025 | 0.3618 | 0.7198 | 0.7975 | 0.4944 | 1.5841 |
| | Min | −0.9879 | 0.4399 | 0.7437 | 0.5431 | 0.5778 | −0.7819 | −3.7568 | 0.1868 | −0.9284 | −2.9568 | −0.6921 | −3.7568 |
| | Max | 0.7553 | 1.9460 | 2.6862 | 2.7346 | 2.4916 | 1.3836 | −0.7294 | 1.9339 | 2.9196 | 1.3716 | 1.7493 | 2.9196 |
| Number of funds | | 21 | 25 | 26 | 27 | 34 | 38 | 46 | 53 | 60 | 64 | | |

Performance measures and their statistics are computed for a sample of balanced, active allocation, and broad-market equity funds as well as absolute return closed-end funds investing in the Polish market. For further details and data sources see the main text.