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PAPER

The Impact of Views on International Portfolio Selection

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Abstract We adopt the Black and Litterman approach in order to find optimal international portfolios and to investigate the sensitivity of their weights to investor's subjective views. We consider fifteen international asset classes and two different sets of views. The results show that BL portfolios can have very different features changing the views, but they are coherent with the views themselves. Resulting portfolios are relatively highly concentrated in asset classes with the better perspectives and present strong negative weights in asset classes with the worst views. We repeat the trials excluding short selling: in the first scenario we obtain well diversified portfolio, while in the second the effect of views gives a more concentrated portfolio.

Keywords: Asset allocation; Market portfolio; Reverse optimization; International optimal portfolios.

JEL classification: C1; G11

1. Introduction

The Markowitz (1952) allocation model provides the basis for modern portfolio theory. Focusing on a suitable restriction of the feasible portfolios based on the mean-variance criterion, the model allows the investor to find the proper optimal portfolio weights. Nevertheless, it often suggests highly concentrated portfolios with high short selling, and it suffers from input sensitivity.

The next fundamental step in portfolio theory is the famous Capital Asset Pricing Model (CAPM) proposed by Sharpe (1964), Lintner (1965) and Mossin (1966) . Their equilibrium framework simplifies greatly the investor problem and points out that the only relevant risky portfolio is the market portfolio: this takes to a world where all investors make exactly the same choices in terms of the risky assets' internal composition, whatever their financial perspectives: the only degree of freedom concerns the amount to be invested in the riskless asset and the remaining amount is allocated in the market portfolio. This means that equilibria assumptions necessarily materialize in unsophisticated investors. The Black Litterman model (1991, 1992) overcomes the problems arising with Markowitz model on one hand and enables

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investors to embedding their personal views in their optimal portfolio choices.

BL adopt a Bayesian approach to combine the investor subjective views on assets expected returns with the market equilibrium expected returns to form a new estimation of expected returns. The resulting new vector of returns becomes the new input to Markowitz optimization problem and it leads to well diversified portfolios, coherently with the views. In this paper we apply BL model to an international portfolio of fifteen asset classes (equity, government bond an real estate indices of Europe, US, Russia and China) and investigate the impact of two different set of views on the optimal portfolio weights.

Section 2 describes the Markowitz and Sharpe, Lintner and Mossin frameworks together with Black and Litterman model. Section 3 shows the data, illustrates the views and exhibits the results (first in presence and then in absence of short selling). The last Section 4 contains conclusions and comments.

2. Portfolio selection

2.1 The classical Markowitz model

The Markowitz (1952) work represents a milestone in portfolio theory. The powerful idea is to focus on what is really important in portfolio decisions, that is to restrict the attention to a subset of portfolios that Markowitz names efficient frontier, instead of considering all possible choices and establishing selection criteria for a single investor. The subset can be found following simple rules when stochastic portfolio return is completely characterized by its mean and variance (this is a crucial and critical point in the model): all investors select their specific optimal portfolio within those minimizing variance for a fixed level of expected return and maximizing expected return for a fixed level of variance. The subset represents a great restriction with respect to all initial feasible portfolios. The techniques developed by Markowitz allows to specify the optimal portfolio composition (the weights) together with its mean and variance once the single investor preferences are specified. More in detail, starting from a set of n stocks and one riskless asset and dealing with a single period horizon, a Markowitz styled investor needs to estimate the n expected asset returns, the riskless asset return and the variance and covariance matrix of asset returns: solving the problem of minimizing portfolio variance for (any) fixed level of portfolio expected return, he finds the minimum variance frontier and a suitable restriction gives the efficient frontier (it is not necessary to solve the other side of the optimization problem). On the basis of the investor preferences (more or less risk adverse), the investor chooses a point on this frontier and he knows exactly how much to invest in any asset in order to obtain the portfolio with return mean and variance corresponding to the point. Unfortunately, the optimal weights are too much sensitive to input data, in particular with respect to the asset mean return vector as pointed out by many financial studies. The development of Markowitz model, due to Sharpe (1964), Lintner (1965) and Mossin (1966) is the famous Capital Asset Pricing Model (CAPM): starting from equilibria assumptions it shows that all investor decisions differ only in terms of the riskless asset weight and the weight of a completely risky portfolio which is the same for all investors (the market portfolio). The optimal composition of the market portfolio is invariant, so that the Markowitz problem

reduces to evaluating the market weights. In this equilibrium framework, first of all it is necessary to identifying the market portfolio: it should be a portfolio containing all the assets all over the world and it is obviously impossible to deal with it. The solution can be referring to a benchmark portfolio with a certain number of specified assets and the weights should be the percentage of benchmark (market) capitalization. Again, solving the Markowitz problem in order to find the benchmark weights gives answers very far from benchmark capitalization percentages because of input data, especially the expected asset returns (Sharpe (1974)).

The next Section is devoted to a model that suggest a way to overcome this criticism and to incorporate personal views in the optimal portfolio weights.

2.2 The Black and Litterman model

Black and Litterman (BL, 1991) start from the idea that the benchmark (market) portfolio weights are known, e.g. they are benchmark (market) capitalization weights. These weights becomes an input of the problem, together with the (historical based) variance-covariance matrix of the assets return. This allows to find the expected return vector implicit in the benchmark. This process is called reverse optimization (Sharpe (1974)), because in this way BL use the Markowitz optimization technique in order to find the expected assets return instead of the optimal weights. This is more reliable than statistic based estimations. BL suggest also a Bayesian approach in order to keeping into account of investor personal views. Without views, the BL implicit expected returns vector can be used as input of the Markowitz problem and the solution in terms of weights gives again the benchmark portfolio. Views can be absolute, e.g. the investor can affirm that a specified index will grow by 3% over the next year, or relative, e.g. the investor believes that an index will outperform another index by 25 basis points (bp). In the BL framework the views allow the investor to find the expected return vector "adjusted" to his views (or BL expected return vector): this vector is the new input together with the historical variance and covariance matrix in the Markowitz optimization problem. Solving the problem the investor finds the BL optimal weights.

BL procedure requires a lot of mathematics to be formalized, so we suggest the interested reader to see the paper by Idzorek (2002) who describes the technique in a very detailed way, with useful examples.

3. Empirical Results

3.1 Data

Weekly data from Bloomberg and Standard & Poor[1] databases have been used. We have considered three main asset classes, namely equities, government bonds and real estate. The historical quotes are referred to the period April 2015 – March 2018 and pertain to 15 indices, relative to Europe, US, Russia and China. We didn't consider in our analysis the Russian property index because we found only indices with quarterly

[1] Source: Bloomberg Finance L.P. and S&P Dow Jones Indices (a division of S&P Global). Closing adjusted prices have been considered.

instead of weekly data.

More in detail, in the numerical application we used:

STOXX Europe 600 Price Index EUR (Bloomberg ticker: **SXXP** Index): a derivation of the STOXX Europe Total Market Index that has 600 components and represents large-mid- and small-capitalization companies across 18 European countries;
S&P 500 Index (**SPX**): a capitalization-weighted index of 500 US stocks;
MSCI Russia Index (**MXRU**): a float-weighted equity index that captures the performance of the large- and mid-capitalization segments of the Russian market, covering approximately 85% of the float-adjusted market capitalization in Russia;

- Shanghai Stock Exchange Index (**SHCOMP**): is a stock market index of all stocks (A shares and B shares) that are traded at the Shanghai Stock Exchange;
- S&P Eurozone Sovereign Bond 1-3 Years Index (hereafter **EU TB 1-3**): this index measures the performance of Eurozone government bonds with maturities between one and three years;
- S&P Eurozone Sovereign Bond 3-5 Years Index (**EU TB 3-5**): this index measures the performance of Eurozone government bonds with maturities between three and five years;
- S&P Eurozone Sovereign Bond 7-10 Years Index (**EU TB 7-10**): this index measures the performance of Eurozone government bonds with maturities between seven and ten years;
- S&P U.S. Treasury Bond 1-3 Year Index (**US TB 1-3**): this index measures the performance of U.S. Treasury bonds with maturities between one and three years;
- S&P U.S. Treasury Bond 3-5 Year Index (**US TB 3-5**): this index measures the performance of Eurozone government bonds with maturities between three and five years;
- S&P U.S. Treasury Bond 7-10 Year Index (**US TB 7-10**): this index measures the performance of Eurozone government bonds with maturities between seven and ten years;
- Russian Government Bond Index (**RGBI**): a weighted index of Russian government bonds;
- FTSE Global Government Yield China Index (**FGGYCN**): it is an index of average yield on Chinese government bonds;
- Bloomberg Europe 500 Real Estate Index (**BEREALE**): a capitalization-weighted index of all companies that are in the real estate sector of the Bloomberg Europe 500 Index;
- Bloomberg NA REITs (**BBREIT**): a weighted index of US Real Investment Trusts with capitalization not less than 15 million dollars;
- Shangai Property Index (**SHPROP**): this Real Estate Index reflects the overall performance of the real estate sector stocks (both A and B shares) that are traded at the Shanghai Stock Exchange.

For each of these indices, we evaluated the logarithmic return (except for FGGYCN which is yet a yield index) and we estimated the historical expected returns and the variance and covariance matrix.
In order to find the benchmark portfolio weights, we used the market index capitalization

weights; the index values expressed in currencies different from dollars were preliminarily converted using foreign exchange rates quoted on March 30, 2018. The application requires estimation of riskless asset return all over the world: we adopted a null risk free return. In the application of BL model a risk-aversion coefficient is needed. We used an estimation based on the benchmark portfolio ratio between historical mean and variance, that gives a value *3.77* for the coefficient.

3.2 Views

This stage is crucial and represents the most difficult step in applying BL model. We try to express very simple views, but in any case this requires a global perspective involving all indices considered in our analysis. Nevertheless, we underline that the main purpose here is to analyse the impact of views on the optimal portfolio composition and that we consider two very simple scenarios with this aim.

- **1st scenario (1st set of views)**: our personal perspective on equity markets is that US commercial war can be dangerous first of all for China and Russia, but also for Europe. Indeed, there can be commercial revenges and at the end we assume that US equity index will outperform China, Russia and Europe equity indices by 50 bp. Moreover, we assume that US rates are expected to grow and this makes attractive US Treasury Bonds, but dollar foreign exchange rates fluctuations makes bond more risky and less attractive for both foreign and domestic investors. In Europe, ECB intends to reduce quantitative easing, so that government bonds rates should rise becoming more risky. How to convert this situation in a BL view? A synthetic possibility is to think that US and European equity index will do better than respective government bonds index. We suppose that US equity index will outperform all Treasury Bond indices by 500 bp or 5%, while European equity index will outperform all European Government Bond indices by 400 bp. Another view on government bonds is that medium and long term bond will do better than short term bonds (even if in some cases a reverse interest rate curve can be observed now) only by 25 bp. With regard to real estate, we suppose that European housing index will outperform US corresponding index by 50 bp and that the Chinese property index will outperform them by 50 bp;
- **2nd scenario (2nd set of views)**: here we suppose that US equity will outperform European equity by 50 bp. We assume that European equity index surpasses the corresponding government bond indices by 400 bp, but US TB outperform them by 200 bp. US equity exceed US TB by 300 bp. Also Chinese equity is supposed to overcome the Chinese bond index by 400 bp. Last, we let unchanged the views on real estate indices.

3.3 Main Results

The next Table 1 exhibits the expected returns vectors based on historical estimation, those implied by reverse optimization and those obtained following the BL approach under the 1st and 2nd scenarios. We report the differences of all returns with respect to the implied vector and it is easy to see that the historical is far from the implied vector.

Table 1

	Expected returns				Differences		
Asset class	Historical expected returns	Implied expected returns	BL expected returns - 1st scenario	BL expected returns - 2nd scenario	Historical-implied	BL 1st-implied	BL 2nd-implied
SXXP	-1.13%	4.12%	4.50%	2.59%	-5.25%	0.38%	-1.53%
SPX	8.06%	3.88%	4.17%	3.10%	4.18%	0.29%	-0.78%
MXRU	5.75%	4.90%	4.77%	3.73%	0.85%	-0.13%	-1.17%
SHCOMP	-5.70%	3.65%	3.12%	3.18%	-9.35%	-0.53%	-0.47%
EU TB 1-3	0.19%	0.01%	0.02%	-0.01%	0.18%	0.01%	-0.02%
EU TB 3-5	0.83%	0.04%	0.07%	-0.03%	0.79%	0.02%	-0.07%
EU TB 7-10	1.50%	0.11%	0.17%	-0.08%	1.39%	0.06%	-0.19%
US TB 1-3	0.26%	-0.03%	-0.01%	0.05%	0.29%	0.02%	0.09%
US TB 3-5	0.19%	-0.10%	-0.03%	0.18%	0.28%	0.07%	0.27%
US TB 7-10	-0.44%	-0.08%	0.09%	0.49%	-0.36%	0.17%	0.58%
RGBI	7.13%	0.57%	0.55%	0.33%	6.56%	-0.01%	-0.24%
FGGYCN	3.30%	0.00%	0.01%	-0.02%	3.30%	0.00%	-0.03%
BEREALE	-3.20%	3.38%	3.80%	1.93%	-6.57%	0.43%	-1.45%
BBREIT	-1.52%	2.62%	2.84%	2.41%	-4.15%	0.22%	-0.21%
SHPROP	2.13%	4.77%	4.18%	3.64%	-2.64%	-0.59%	-1.13%
High	8.06%	4.90%	4.77%	3.73%	6.56%	0.43%	0.58%
Low	-5.70%	-0.10%	-0.03%	-0.08%	-9.35%	-0.59%	-1.53%

The following Table 2 displays the optimal weights based on historical expected returns, those based on implied returns that coincide with the market capitalization weights and, last, the BL weights (combining implied returns and views) together with the differences between BL and market capitalization weights.

Table 2

	Weights				Differences		
Asset class	based on historical	based on implied=mkt weights	BL weights - 1st scenario	BL weights - 2nd scenario	Historical-implied	BL 1st-implied	BL 2nd-implied
SXXP	-6.84%	19.84%	24.40%	3.50%	-26.68%	4.56%	-16.34%
SPX	13.51%	44.94%	50.56%	46.91%	-31.43%	5.62%	1.96%
MXRU	-1.24%	0.36%	-2.43%	0.36%	-1.60%	-2.80%	0.00%
SHCOMP	-4.27%	9.95%	7.15%	13.39%	-14.22%	-2.80%	3.44%
EU TB 1-3	-386.55%	2.95%	-12.26%	-32.18%	-389.50%	-15.21%	-35.12%
EU TB 3-5	268.46%	2.56%	6.48%	-32.57%	265.91%	3.93%	-35.12%
EU TB 7-10	-34.98%	2.84%	6.77%	-32.29%	-37.82%	3.93%	-35.12%
US TB 1-3	325.16%	5.09%	-16.29%	45.01%	320.06%	-21.39%	39.92%
US TB 3-5	-113.20%	3.51%	15.59%	43.43%	-116.71%	12.08%	39.92%
US TB 7-10	4.95%	1.54%	13.62%	41.46%	3.41%	12.08%	39.92%
RGBI	20.20%	0.15%	0.15%	0.15%	20.05%	0.00%	0.00%
FGGYCN	19.54%	3.53%	3.53%	0.09%	16.01%	0.00%	-3.44%
BEREALE	-4.62%	0.36%	0.69%	-5.24%	-4.98%	0.33%	-5.60%
BBREIT	-2.66%	2.13%	1.47%	9.91%	-4.80%	-0.66%	7.77%
SHPROP	2.54%	0.24%	0.56%	-1.94%	2.30%	0.33%	-2.18%
High	325.16%	44.94%	50.56%	46.91%	320.06%	12.08%	39.92%
Low	-386.55%	0.15%	-16.29%	-32.57%	-389.50%	-21.39%	-35.12%

First of all, Table 2 shows that Markowitz classical optimization based on historical mean return estimations gives unreliable weights in our application. Historical based weights are very far from market (benchmark) capitalization weights and massive short sales of some asset class should be optimal. Coming to BL, in the 1st scenario the optimistic views on US equity reinforce SPX weight by 5.62%, while EU equity rises by 4.56% due to the better perspective with respect to EU TB. The views bring to a reduction of both Chinese and Russian equity weights. BL model suggests to short selling EU and US short term and increasing medium and long term government bonds weights (especially US). Russian and Chinese government bonds percentages remain unchanged, coherently with the fact that there are no views for these asset class. Last, there is a small reduction in US property index, exactly balanced by a growth in EU and Chinese real estate indices.

The 2nd scenario gives rise to a great reduction in EU equity while US equity increase by 1.96%. Chinese equity index increases by 3.44%, balancing the drop in Chinese bonds. RGBI remains unchanged. The most relevant changes refer to US and EU government bonds: BL application suggest high short selling of European in favour of a relevant growth of US bonds. Last, US property index rises by 7.77% while EU and Chinese real estate indices drops, respectively, by 5.6% and 2.18%.

Now, we suppose that short sales are not allowed. Table 3 exhibits BL weights in this situation.

Table 3

	Weights in absence of short sales			Differences	
Asset class	**based on implied=mkt weights**	**BL weights - 1st scenario**	**BL weights - 2nd scenario**	**BL 1st- implied**	**BL 2nd- implied**
SXXP	19.84%	25.12%	20.28%	5.27%	0.44%
SPX	44.94%	47.88%	18.64%	2.94%	-26.30%
MXRU	0.36%	0	0.41%	-0.36%	0.05%
SHCOMP	9.95%	8.86%	11.37%	-1.09%	1.42%
EU TB 1-3	2.95%	0	0	-2.95%	-2.95%
EU TB 3-5	2.56%	0.08%	0	-2.47%	-2.56%
EU TB 7-10	2.84%	0.39%	0	-2.45%	-2.84%
US TB 1-3	5.09%	0	17.52%	-5.09%	12.42%
US TB 3-5	3.51%	6.54%	15.71%	3.03%	12.20%
US TB 7-10	1.54%	4.38%	13.46%	2.84%	11.92%
RGBI	0.15%	0.17%	0.17%	0.01%	0.02%
FGGYCN	3.53%	3.86%	0	0.33%	-3.53%
BEREALE	0.36%	0.70%	0	0.34%	-0.36%
BBREIT	2.13%	2.03%	2.44%	-0.11%	0.30%
SHPROP	0.24%	0	0	-0.24%	-0.24%
High	44.94%	47.88%	20.28%	5.27%	12.42%
Low	0.15%	0.00%	0.00%	-5.09%	-26.30%

In the 1st scenario, the results show again a reinforcement of US and EU equity components: together they represent almost 73% of the optimal BL portfolio. There is a small reduction of Chinese equity (US, EU and Chinese equity gives more than 80%). EU medium and long term government bond are strongly reduced while the corresponding US asset classes grow up by 3.03% and 2.84% (approximately doubled with respect to market capitalization percentages). Russian and Chinese bonds are slightly increased while EU and US real estate indices are slightly reduced.

The 2nd set of views is substantially characterized by a strong reduction (-26.3%) of EU equity and by a strong reinforcement of all US TB indices (around +12% each of them).

4. Conclusions

In this paper we adopt the Black and Litterman approach in order to find optimal international portfolios. BL model has substantially two main qualities: first, its structure grants the possibility to overcome some criticisms arising in applying directly Markowitz optimization techniques and, second, it allows to incorporate personal investor views in the optimal portfolio selection process. In our work, we consider fifteen international asset classes and we investigate the sensitivity of BL optimal portfolio weights to two different sets of views. The results show that BL portfolios can have very different features changing the views, but they seem to be coherent with the views themselves. Resulting portfolios are relatively highly concentrated in asset classes with the better perspectives and present strong negative weights in asset classes with the worst views. We repeat the trials excluding short selling: in the first scenario we obtain well diversified portfolio, while in the second the effect of views gives a more concentrated portfolio. This suggests the importance of a careful calibration of the views.

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