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Barbell strategy with bond portfolios: theory review and empirical study with government bond portfolios of Vietnam Prosperity Joint Stock Commercial Bank in 2018

Abstract. The Barbell strategy is founded on the methodology initiated by the economic professor Harry Markowitz in a «portfolio theory» [2]. This strategy is mostly conducted by big scale institutions to cope with volatilities of market interest rates, diversify portfolios and increase the probability of higher return. The Barbell strategy is one of the fixed income securities investment strategies, focusing on short-term and long-term bonds and ignoring medium-term bonds, with the aim of balancing between liquidity and profit. In the context of a stable economy, the Barbell strategy is considered an advisable tool for big investors such as commercial banks, which helps them to construct their bond portfolios in not only preserving liquidity but also in ensuring sustainable profit. Besides reviewing the contents of the Barbell strategy and the forecasted yield curve of Vietnamese government bonds in 2018, the authors also test this strategy with Vietnam Prosperity Joint Stock Commercial Bank's Portfolio in Vietnam Government Bonds in 2018. The suggested portfolio is classified into four types of bonds: one-year bonds (EUR 269.117 million); three-year bonds (EUR 459.082 million); ten-year bonds (EUR 708.412 million); and fifteen-year bonds (EUR 19.789 million). This application demonstrates the feasibility and reliability of the Barbell strategy.

Keywords: Barbell Strategy; Portfolio; Government Bonds; Duration; Yield Curve

JEL Classification: B23; C22; C41; C52; G11

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Стратегія Барбелла для портфеля облігацій: огляд теорії та емпіричне дослідження портфеля державних облігацій акціонерного комерційного банку «Процвітання В'єтнаму» в 2018 році

Анотація. Стратегія Барбелла засновано на методології портфельної теорії, розробленої професором Гаррі Марковіцем. Дана стратегія використовується переважно великими установами для того, щоб долати коливання ринкових процентних ставок, диверсифікувати портфель і забезпечувати більшу прибутковість. Стратегія Барбелла – це одна зі стратегій, що стосується інвестиційних цінних паперів, особливу увагу в якій приділено короткостроковим і довгостроковим облігаціям, пропускаючи при цьому середньострокові облігації, для пошуку балансу між ліквідністю й прибутковістю. В умовах стабільної економіки стратегія Барбелла вважається дієвим інструментом для великих інвесторів, якими, наприклад, є комерційні банки. Таким інвесторам вона допомагає створити власні портфелі облігацій і не тільки зберегти ліквідність, але й забезпечити стійку прибутковість. Крім відображення змісту стратегії Барбелла й прогнозу кривої прибутковості в'єтнамських державних облігацій у 2018 році, автори статті апробували зазначену стратегію на прикладі портфеля державних облігацій акціонерного комерційного банку «Процвітання В'єтнаму». Цей портфель представлено чотирма видами облігацій: однорічними облігаціями на суму 269,117 мільйонів євро, трирічними облігаціями на суму 459,082 мільйонів євро, десятирічними облігаціями на суму 708,412 мільйонів євро та п'ятнадцятирічними облігаціями на суму 19,789 мільйонів євро, використання яких підтверджує надійність й обґрунтованість стратегії Барбелла.

Ключові слова: стратегія Барбелла; портфель; державні облігації; тривалість; крива прибутковості.

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Стратегия Барбелла для портфеля облигаций: обзор теории и эмпирическое исследование портфеля государственных облигаций акционерного коммерческого банка «Процветание Вьетнама» в 2018 году

Аннотация. Стратегия Барбелла основана на методологии портфельной теории, разработанной профессором Гарри Марковицем. Данная стратегия используется преимущественно крупными учреждениями для того, чтобы преодолевать колебания рыночных процентных ставок, диверсифицировать портфель и обеспечить большую доходность. Стратегия Барбелла – это одна из стратегий, касающаяся инвестиционных ценных бумаг, особое внимание в которой уделено краткосрочным и долгосрочным облигациям, опуская при этом среднесрочные облигации, для поиска баланса между ликвидностью и доходностью. В условиях стабильной экономики стратегия Барбелла считается действенным инструментом для крупных инвесторов, какими, например, являются коммерческие банки. Таким инвесторам она помогает создать собственные портфели облигаций не только путем сохранения ликвидности, но и путем обеспечения устойчивой доходности. Помимо отображения содержания стратегии Барбелла и прогноза кривой доходности вьетнамских государственных облигаций в 2018 году, авторы статьи апробировали указанную стратегию на примере портфеля государственных облигаций акционерного коммерческого банка «Процветание Вьетнама». Рассматриваемый портфель представлен четырьмя видами облигаций: однолетними облигациями на сумму 269,117 миллионов евро, трехлетними облигациями на сумму 459,082 миллионов евро, десятилетними облигациями на сумму 708,412 миллионов евро и пятнадцатилетними облигациями на сумму 19,789 миллионов евро, использование которых подтверждает надежность и обоснованность стратегии Барбелла.

Ключевые слова: стратегия Барбелла; портфель; государственные облигации; длительность; кривая доходности.

1. Introduction

The Barbell strategy is one of the most popular portfolio diversification strategies, primarily used by large fixed income investors who consider portfolios consisting of short-term and long-term securities with the purpose of minimising interest rate risks on a profit-maximising basis. This strategy has few or even zero investments in medium-term securities [2]. The research applies the Barbell strategy on the basis of the Vietnamese government bonds in Vietnamese dong with regard to the Vietnam Prosperity Joint Stock Commercial Bank (VPBank) in 2018.

2. Theoretical basis

A portfolio is a range of securities, commodities, real estate, cash equivalents or other assets held by an individual or an organisation [3]. Forming a portfolio is putting money into securities with various risk levels by different investment shares in the market, or building a reasonable asset structure to diversify or minimise risks [4].

A government bond is a bond issued by the government and has its term, face value, interest rate, as well as the Government's debt repayment obligation before bondholders. Government bonds are generally considered risk-free because the government may raise taxes or print more money to pay for bonds at maturity. Government bonds include: 1) a Treasury-bill (T-bill), a type of bond issued by the State Treasury with a less than one-year term in the form of a discount or interest payment at maturity; 2) a Treasury bonds (T-bond), a type of bond issued by the State Treasury with a more than one-year term, usually with interests paid periodically [5].

A yield curve represents interest rates at different maturities of the same debt, showing a relationship between the borrowing cost and the time to maturity [6-11]. To effectively manage a portfolio, the yield curve is a prerequisite for investors to decide which bonds to invest in and how long they should be held. The yield curve is useful for a variety of purposes: investors use it to decide the expected interest rate by adding a risk premium to cover liquidity risk, credit risk, and profit [6]; it is also a parameter for the investors or financial managers to estimate profit/loss of bonds in their portfolio; risk managers need the yield curve to measure the portfolio risk, especially the market risk, which makes it possible to set limits based on an acceptable risk appetite [7].

Bond duration is considered a key to most innovations in the modern management of bond portfolio. Macaulay [8] was the first to mention the concept of duration and scope of its application. Having found different incomes generated from securities with the same maturity, Macaulay [8] introduced the concept of duration to explicitly account for the relative holding period of bonds and applied in asset management of insurance

companies. Duration is introduced as a weighted average maturity of bonds. To consider a set of fixed cash flows generated from a bond, the present value of the i -th cash flow is used:

$$PV_i = \frac{F_i}{(1+r)^i} \quad (1)$$

The Macaulay duration is defined as:

$$MacD = \frac{\sum_{i=1}^n t_i PV_i}{\sum_{i=1}^n PV_i} = \frac{\sum_{i=1}^n t_i \frac{F_i}{(1+r)^i}}{\sum_{i=1}^n \frac{F_i}{(1+r)^i}} \quad (2)$$

where:

i is index of the cash flows;

PV_i is the present value of the i -th cash payment from the bond;

t_i is the time in years until the i -th payment will be received;

r is the expected rate of return.

In the second expression, the fractional term is the ratio of the cash flow PV_i to the total PV . These terms add to 1.0 and serve as weights for a weighted average. Thus, the overall expression is a weighted average of time until cash flow payments, with the weight $\frac{PV_i}{PV}$, being the proportion of the present value of assets due to the cash flow i .

The duration is measured in years. The duration of a bond increases in the same direction as the bond maturity, however it shorter than it. In the case of a zero-coupon bond, the bond's remaining time to its maturity date is equal to its duration. The higher the coupon rate of a particular bond is, the shorter its duration will be. In other words, the more money is attracted (because of a higher rate), the faster the cost of the bond will be recovered, and the investors would need to wait a shorter period to receive the coupon payments and principal. Thus, duration is the weighted average maturity of fixed income securities, reflecting the volatility of bond prices when interest rates change. It helps assess the change in bond value, when there is a change in interest rates.

The Barbell strategy is based on the methodology initiated by the economic professor Harry Markowitz in a «portfolio theory» which developed into «portfolio choices» [2], stating that the overall risk of a portfolio drops significantly when a proper mix of investments is achieved. Based on Markowitz's theory, William Sharpe and Jan Mossin established modern financial modelling with the CAPM model [9-10] as the first quantitative model forming the correlation between risk and profit. According to the theory, investors target at maximising their expected return of a portfolio at an acceptable level of risk. Having assumptions of investment holding period and risk attitude of investors, risks can be measured by the variance or standard deviation of

the portfolio's rate of return. William Sharpe, among other scientists, found a way to simplify the input processing and data arrangement to determine the correlation of investments [9]. Mitigating risks through diversification in the portfolio measured by its variance and the covariance in pairs of all assets, the Barbell strategy is a model that satisfies the balance between the rate of return and the risk for all assets. In the portfolio optimisation model, it is found that the return on any asset is linearly related to its market beta. A negative beta represents the securities unlinear by the market and is removed as soon as the investment option is chosen. Similarly, the securities, which earn a return lower than the risk-free rate, are also removed from the portfolio because the risks inherent to the investment are not adequately compensated by profitability [9]. The model results show a relatively high (approximately 1) correlation between returns and risks. This means that short-term securities, providing liquidity and long-term investments with higher profitability, are closely correlated. It is important to consider the ratio of short-term and long-term securities in the selected portfolio.

$$D_i = \sum W_{si} \times D_{si} + \sum W_{lj} \times D_{lj}, \quad (3)$$

where:

D_i is targeted duration;

W_{si} is proportion of short-term bond i compared to the whole portfolio;

D_{si} is duration of short-term bond i ;

W_{lj} is proportion of long-term bond j compared to the whole portfolio;

D_{lj} is duration of long-term bond j .

To calculate W_{si} and W_{lj} , the following steps should be taken:

Step 1: Determine how long the portfolio is held.

Step 2: Predict the yield curve of the selected bond.

Step 3: Based on the budget limit and expected return for the bond portfolio, determine the targeted duration for the bond portfolio.

Balancing the reasonable risk and return rates in a portfolio is extremely important. It is essential to have a portfolio that balances short-term and long-term securities at an appropriate timing [11]. To form a bond portfolio that follows the Barbell Strategy, two factors that investors need to determine are the yield curve and the duration of this bond.

3. Research methodology

3.1. Data source and processing methods

The secondary data used in research include: government bond yields from 1 May 2011 to 31 December 2017 with various maturities of 1 year, 2 years, 3 years, 5 years, 10 years and 15 years collected by Bloomberg, used to forecast the interest rate of government bonds maturing in 2018; a VPBank Annual Report used to apply the Barbell strategy for the 2018 government bond portfolio in VPBank. VPBank was among the top four commercial banks in Vietnam based on the research by Brand Finance in 2017 [1]. In terms of profitability, VPBank ranked third with a lesser difference from the top 2 domestic commercial banks. Attributing to this success, VPBank uses bond investments as one of the major services which comprises a significant share in the total bank's revenue.

Most government bonds invested by Vietnamese commercial banks have maturities of 1 year, 2 years, 3 years, 5 years, 10 years and 15 years. The ARIMA model is applied to forecast interest rates on government bonds. To simulate the yield curve, the study forecasts interest rates corresponding to each term for subsequent periods, using the ARIMA model. In particular, the technique chosen is to automatically predict the suitability standards of the model. For each data series, EVIEWS software automatically selects the format of the predictor variable (initial or differential) and the corresponding lag length of AR and MA by running all models within the lag limit. The software will select the model with the best AIC criteria as the forecasting model.

3.2 Methodology specified in the research framework

A research framework is visualised in Figure 1. The determinants for applying the Barbell strategy to the bond portfolio at VPBank in 2018 include: the forecasted volatility of government bond yields used to establish its yield curve in 2018, the duration of the government bond portfolio (calculated by the

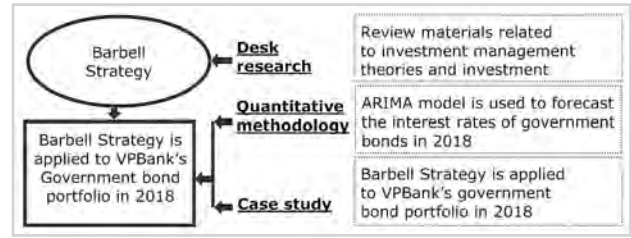


Fig. 1: Research Framework
Source: Compiled by the authors

first derivative of the regression formula of the present values of cash flows) and the share W_i and W_j for each bond term.

4. Test results

4.1. Projection of government bonds in 2018

To forecast the yield curves, the interest rates for next periods are predicted by the ARIMA forecasting model. In particular, the technique chosen is to automatically predict by the suitability standards of the model. For each data series, EVIEWS software automatically selects the format of the predictor variable (initial or differential) and the corresponding lag length of AR and MA. By running all models within the lag limit, the software will select the model with the best AIC criteria as the forecasting model [13].

Estimate equation of the ARIMA model (p, q) with the dependent variables in the form of first order differential equations and criterion of model selection

$$(Y_t - Y_{t-1} - c)(1 - \theta_1 L - \theta_2 L^2 - \dots - \theta_p L^p) = u_t(1 + \delta_1 L + \delta_2 L^2 + \dots + \delta_q L^q), \quad (4)$$

of which: $L X_t = X_{t-1}$ and $L^k X_t = X_{t-k}$,

where:

c is the intercept coefficient in regression results;

$\theta_1, \theta_2, \dots, \theta_p$ are corresponding coefficients of AR(1), AR(2), ..., AR(p);

$\delta_1, \delta_2, \dots, \delta_q$ are corresponding coefficients of MA(1), MA(2), ..., MA(q).

The estimate equation is:

$$Y_t - \theta_1 Y_{t-1} - \dots - \theta_p Y_{t-p} - Y_{t-1} + \theta_1 Y_{t-2} + \dots + \theta_p Y_{t-p-1} = c(1 - \theta_1 - \dots - \theta_p) + u_t + \delta_1 u_{t-1} + \dots + \delta_q u_{t-q}, \quad (5)$$

or:

$$\hat{Y}_t = c(1 - \theta_1 - \dots - \theta_p) + (1 + \theta_1)Y_{t-1} + (\theta_2 - \theta_1)Y_{t-2} + \dots + (\theta_p - \theta_{p-1})Y_{t-p} - \theta_p Y_{t-p-1} + \delta_1 u_{t-1} + \dots + \delta_q u_{t-q}. \quad (6)$$

Then:

If $t \leq q$, then $u_t = 0$.

If $t > q$, then $u_t = Y_t - \hat{Y}_t - Y_{t-1} + \hat{Y}_{t-1}$.

With the time series model, one of the criteria for choosing models is the rationality criterion, of which the commonly used one is the Akaike Information Criterion (AIC). In particular, the AIC with the maximum rational estimates is calculated by the formula:

$$AIC = -2 \log L + 2k. \quad (7)$$

$\log L$ is the logarithm of the rational function of model estimation and k is the number of coefficients present in the model. This criterion evaluates the trade-off between the regression rationality and the model complexity, whereby a smaller AIC indicates a better model.

Forecast of interest rates by different terms

Based on the selected forecasting model, the generated sequences are in first-order differential form. Then, an Augmented Dickey-Fuller Test is used for the time series of interest rate differential with results is presented in Table 1.

Both the ADF and the PP tests indicate that the series of first-order differential form are those with even intercept coefficient, since the probabilities of tests are less than 1% or the tested series have stopped at the 1% significance level.

The models chosen for forecasting each interest rate series are shown in Table 2.

Forecast errors of the selected models are presented in Table 3.

Simulation of the yield curve at selected dates in 2018

The yield curve is forecasted by using the ARIMA model at selected dates in 2018 (Figure 2).

As a result, the forecasts show that the Government bond yield curve for 2018 with various terms is a normal yield curve with upward-sloping, lower interest rates for short terms and higher interest rates for long terms. This shows a relatively stable evolution of Vietnam's economy in 2018 and the use of conservative strategies in the short term and aggressive in the long term.

4.2. Application of the Barbell strategy for the government bond portfolio of VPBank in 2018

In 2018, VPBank plans to invest VND1 40 trillion (EUR 1,456,400 million) to target a profit of VND 1,900 billion (EUR 69,178.9 million) [12].

Having such targets, a Barbell portfolio of the government bonds is formulated, consisting of short-term bonds (50%) and long-term bonds (50%).

Adopting the Macauley formulas [8], the study assumes the share of bonds in the portfolio, the reinvestment effect on cash flows and the capitalisation effect of bond prices, combined with the yield to maturity of investors (VPBank in this case), and the maturity of bond portfolio as follows: VPBank invests in bonds of 1-year, 3-year, 10-year and 15-year maturities.

The bank's budget for bond investment is M .
Time: the bank is assumed to hold this portfolio in n (years).

The maturity of TP_1 is n_1 years.
The maturity of TP_2 is n_2 years.
The maturity of TP_3 is n_3 years.
The maturity of TP_4 is n_4 years.

Interest rate:
The yield to maturity that the bank determines for this portfolio is r ;

The market interest rate of TP_1 at the portfolio starting time is y_1 ;
The market interest rate of TP_2 at the portfolio starting time is y_2 ;
The market interest rate of TP_3 at the portfolio starting time is y_3 ;
The market interest rate of TP_4 at the portfolio starting time is y_4 .
To have this portfolio, the following conditions must be met:

According to Macauley [8]:

$$w_1 * D_1 + w_2 * D_2 + w_3 * D_3 + w_4 * D_4 = n \quad (1)$$

where:

D_i is the duration of TP_1, TP_2, TP_3 and TP_4 ;
 w_i is the weight of each bond on the portfolio. For example, $w_1 = \frac{P_1}{M}$ with P_1 is the bank's investment in TP_1 .

The Barbell portfolio requires:

$$w_1 + w_2 = 0.5;$$

$$w_3 + w_4 = 0.5.$$

In order to satisfy the holding period, the coupons are reinvested and the bond principals are capitalised. The total value of the portfolio on the maturity date is equal to the expected profitability of the initial investment by the bank. In other words, the following equation must be satisfied:

$$M * (1+r)^n = (P_1 + F_1) * (1 + y_1)^{n-n_1} + F_2 * \left[\frac{(1+y_2)^{n_2} - 1}{y_2} \right] * (1 + y_2)^{n-n_2} + P_2 * (1 + y_2)^{n-n_2} + F_3 * \left[\frac{(1+y_3)^{n_3} - (1+y_3)^{n-n_3}}{y_3} \right] + P_3 * (1 + y_3)^{n-n_3} + F_4 * \left[\frac{(1+y_4)^{n_4} - (1+y_4)^{n-n_4}}{y_4} \right] + P_4 * (1 + y_4)^{n-n_4} \quad (9)$$

It is assumed that VPBank invests VND 40,000 billion in government bonds in 2018, with a 5% rate of return expected for this portfolio in a 5-year holding period. Applying the Barbell strategy, the bank chooses to contain 1-year, 3-year, 10-year and 15-year bonds in their portfolio. These bonds have coupon rates of 3%, 4.5%, 6% and 7%, respectively. The discount rates valid on the purchase date of these bonds (13 February 2018) are shown in Table 4.

Applying the stated conditions, the investments are classified as follows:

- 1-year bonds: VND 7,391.3 billion (EUR 269,117 million);
- 3-year bonds: VND 12,608.7 billion (EUR 459,082 million);
- 10-year bonds: VND 19,456.5 billion (EUR 708,412 million);
- 15-year bonds: VND 543.5 billion (EUR 19,789 million).

1 The exchange rate VND/EUR = 27.465 as of 13 February 2018

Tab. 1: ADF Test for the time series of interest rate differential

	Series form	Testing form	Series feature	P-value
15-year term	First-order differential	ADF	With intercept coefficient	0.0000
		PP	With intercept coefficient	0.0000
10-year term	First-order differential	ADF	With intercept coefficient	0.0000
		PP	With intercept coefficient	0.0000
5-year term	First-order differential	ADF	With intercept coefficient	0.0000
		PP	With intercept coefficient	0.0000
3-year term	First-order differential	ADF	With intercept coefficient	0.0000
		PP	With intercept coefficient	0.0000
2-year term	First-order differential	ADF	With intercept coefficient	0.0000
		PP	With intercept coefficient	0.0000
1-year term	First-order differential	ADF	With intercept coefficient	0.0000
		PP	With intercept coefficient	0.0000

Source: Compiled by the authors based on forecast of interest rates for 2018 government bonds

Tab. 2: Selected models for forecasting each interest rate series

15-year interest rate		
Model ARIMA(p,q)	LogL	AIC*
(2,9)	1260.909026	-4.464791
(3,9)	1261.76741	-4.464284
(2,10)	1261.731242	-4.464155
(9,1)	1258.638583	-4.460245
(8,0)	1256.608911	-4.460139
10-year interest rate		
Model ARIMA(p,q)	LogL	AIC*
(9,11)	1942.571	-7.71314
(9,9)	1939.689	-7.70959
(6,4)	1931.059	-7.70706
(10,8)	1938.183	-7.70355
(5,4)	1928.948	-7.7026
5-year interest rate		
Model ARIMA(p,q)	LogL	AIC*
(10,11)	1400.84	-3.689
(9,5)	1393.354	-3.6877
(12,8)	1399.353	-3.68769
(12,10)	1400.972	-3.68667
(8,4)	1390.78	-3.68616
3-year interest rate		
Model ARIMA(p,q)	LogL	AIC*
(8,8)	1165.836	-3.54271
(6,6)	1161.457	-3.54154
(9,5)	1162.167	-3.53755
(6,5)	1158.934	-3.53683
(6,7)	1160.64	-3.53593
2-year interest rate		
Model ARIMA(p,q)	LogL	AIC*
(10,8)	1285.056	-3.38703
(7,5)	1277.452	-3.38274
(6,5)	1276.277	-3.38227
(5,6)	1276.265	-3.38223
(8,10)	1282.671	-3.38065
1-year interest rate		
Model ARIMA(p,q)	LogL	AIC*
(6,4)	1226.782	-3.25243
(2,4)	1221.501	-3.249
(4,2)	1221.342	-3.24857
(3,3)	1220.806	-3.24714
(2,0)	1216.627	-3.24666

Source: Compiled by the authors based on forecast of interest rates for 2018 government bonds

Tab. 3: Forecast errors of the selected models

Variable	Forecast errors
15-year interest rate	7.87%
10-year interest rate	9.53%
5-year interest rate	9.12%
3-year interest rate	9.55%
2-year interest rate	2.71%
1-year interest rate	4.77%

Source: Compiled by the authors based on forecast of interest rate for 2018 government bonds

5. Conclusion

5.1. Recommendations for the use of the Barbell strategy

The Barbell strategy will effectively work in the following conditions.

Firstly, the forecasts of interest rates are correct and sufficient, which accommodate all macroeconomic fluctuations and external shocks, if any. Having changes in the economy, interest rates will be immediately affected, which leads

Tab. 4: Forecast errors of the selected models

No.		1-year	3-year	10-year	15-year
1	Purchase date	15/01/18	15/01/18	15/01/18	15/01/18
2	Maturity date	15/01/19	15/01/21	15/01/28	13/01/33
3	Coupon rate	3%	4.50%	6%	7%
4	Market interest rate	3.16%	4.55%	6.34%	7.36%
5	Number of annual coupons	1	1	1	1
6	Day count convention code	1	1	1	1
	Duration	1	2.872573363	7.770677565	9.654996132

Source: Forecast of interest rate for 2018 government bonds by the authors

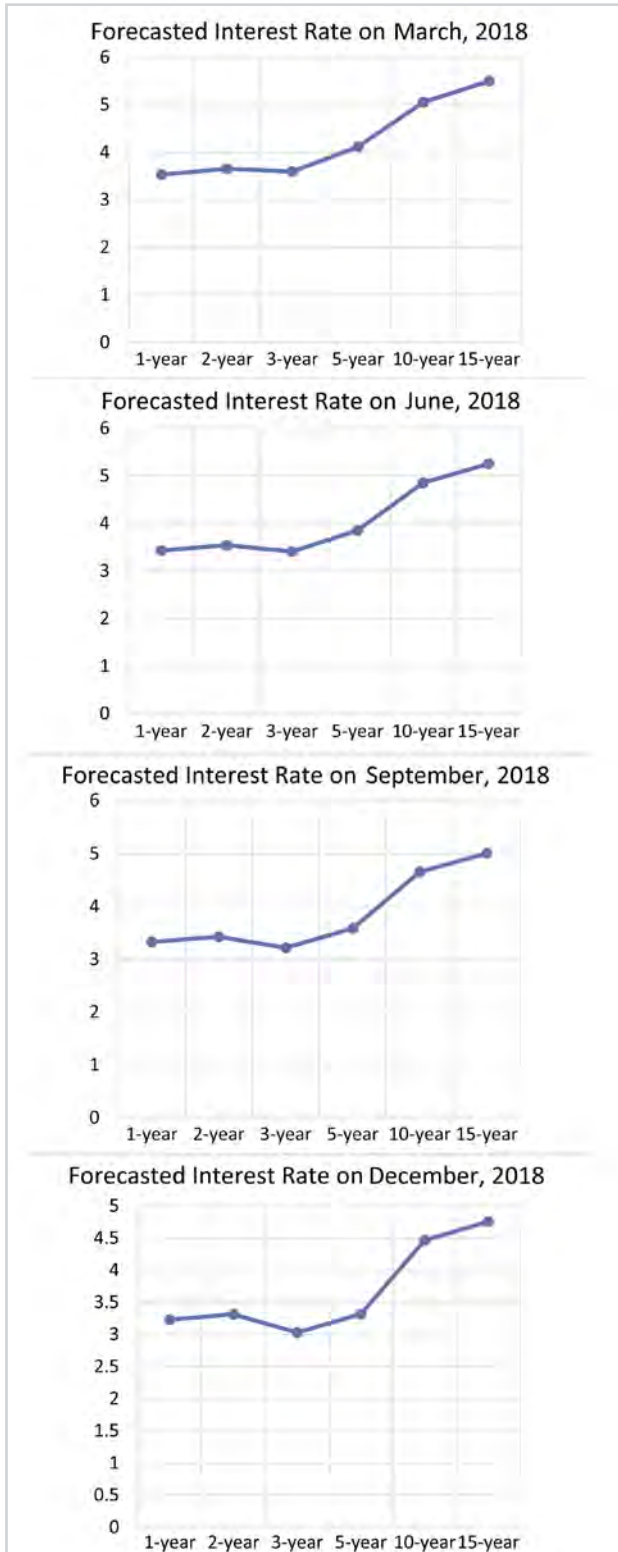


Fig. 2: Forecasted yield curve of government bonds in 2018
Source: Compiled by the authors based on forecast of interest rate for 2018 government bonds

to changes in bond prices and expected portfolio performance as a consequence.

Secondly, yield curves of government bonds should be built accurately, which helps to reflect the whole picture of market references for investors, which should serve as guidance when making decision.

Thirdly, the shape of yield curves is a prerequisite for an effective Barbell strategy. It should be normal with its upward sloping. The longer the maturity is, the higher the interest rate is. Consequently, the difference between short, medium and long-term interest rates is moderate.

If the yield curve is in the state of diversion, the effects of Barbell Strategy will not be applicable.

Fourthly, investment in government bonds must be mostly due to large scale investors, which is easily satisfied by commercial banks because their size of bond investment is often a multiple of that by common investors. In the current context, the majority of Vietnamese commercial banks choose government bonds as the key securities in their portfolio for the purposes of maintaining both liquidity and profitability.

5.2. Limitations of study

The research sets out the possibility of the Barbell strategy with bond portfolio management. Other limitations can be defined as follows:

- 1) a broader picture of macroeconomic forecasts should be covered;
- 2) only a government bonds portfolio is considered in the study, yet the two common categories of bond portfolio in commercial banks include the trading book and the bank book;
- 3) transaction costs payable from the bond portfolio have not been taken into consideration.

Thus, the focus on short-term and long-term securities at VPBank has proven that the Barbell strategy enables to select an effective and sufficient investment strategy that investors should consider in order to balance liquidity and profitability of their portfolios in the current context.

References

1. Brand Finance (2017). *The Brand Finance Top 50 Vietnamese Brands 2017*. Retrieved from http://brandfinance.com/images/upload/bf_vietnam_2017_en_locked.pdf
2. Markowitz, H. M. (1959). *Portfolio selection: Efficient diversification of investments*. Monograph. Research in Economic at Yale University. Retrieved from <http://cowles.yale.edu/sites/default/files/files/pub/mon/m16-all.pdf>
3. Schultz Collins Lawson Chambers, INC. Investment Counsel (2008). *Portfolio management: Theory and Practice*. Retrieved from http://schultzcollins.com/static/uploads/2014/10/Theory_and_Practice_08_04.pdf
4. HSBC (2009, August 22). *Diversification of Portfolio*. Retrieved from <http://tinhnhanchungkhoan.vn/chung-khoan/da-dang-hoa-danh-muc-dau-tu-60702.html> (in Vietnamese)
5. Kapoor, J. R. (2015). *Personal financial planning and Insurance*. McGraw-Hill.
6. Estrella, A. (2005a). Why does yield curve predict output and inflation? *The Economics Journal*, 115(505), 722-744. Retrieved from <https://www.jstor.org/stable/3590455>
7. Estrella, A. (2005b). The yield curve and recessions. *The International Economy*, 19, 8- 11. Retrieved from http://www.international-economy.com/TIE_SU05_Estrella.pdf
8. Macaulay, F. R. (1938). *Some theoretical problems suggested by the movements of interest rates: bond yields and stock prices in the United States since 1856*. New York: National Bureau of Economic Research Retrieved from <https://trove.nla.gov.au/work/9861148>
9. Sharpe, W. F. (1964). Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk. *Journal of Finance*, 19(3), 425-442. doi: <https://doi.org/10.2307/2977928>
10. Mossin, J. (1968). Optimal Multi-period Portfolio Policies. *The Journal of Business*, 41(2), 215-229. doi: <https://doi.org/10.1086/295078>
11. Jones, F. J. (1991). Yield curve strategies. *The Journal of Fixed Income*, 1(2), 43-48. doi: <https://doi.org/10.3905/jfi.1991.408020>
12. Vietnam Prosperity Joint-Stock Commercial Bank (VPBank) (2018). *VPBank Annual Report 2017*. Retrieved from <http://www.vpbank.com.vn/bai-viet/annual-reports/vpbank-annual-report-2017?target=en>
13. Box, G. P. E., Jenkins, G. M., Reinsel, G. C., & Ljung, G. M. (2015). *Time Series Analysis: Forecasting and Control* (5th ed.). John Wiley & Sons. Inc.
14. Rhys, H., & Tippett, M. (1996). Duration and interest rate risk for uncertain cash flow streams. *Journal of Business Finance and Accounting*, 23(1), 115-123. doi: <https://doi.org/10.1111/j.1468-5957.1996.tb00406.x>
15. Levisauskaite, K. (2010). *Investment Analysis and Portfolio Management*. Kaunas: Vytautas Magnus University. Retrieved from http://www.bcci.bg/projects/latvia/pdf/8_IAPM_final.pdf

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