



Innovative Applications of the Core Ideas of Professional Knowledge in Financial Engineering for Developing Postgraduate Admission Strategies

Zedong Cai

School of Finance, Shanghai University of Finance and Economics, Shanghai, China

Email: m18058695690@163.com

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Abstract

In the face of increasingly fierce competition for postgraduate admission, how to develop and optimize the strategies is worth exploring. This paper further explores the characteristics (innovative, interdisciplinary, applicative, etc.) and core knowledge (stochastic process, risk management, portfolio optimization, etc.) of financial engineering, applying them to dealing with the issues.

Subject Areas

Social Sciences, Finance

Keywords

Financial Engineering, Professional Knowledge, Innovative Thinking, Postgraduate Admission

1. Introduction

Financial engineering is an interdisciplinary discipline that integrates the knowledge system of economics, finance, mathematics, statistics, computer science and other fields. It has a history of more than 20 years since the Ministry of Education established the corresponding undergraduate major in 2002. With the rapid development of big data, artificial intelligence and other technologies, the integration trend of the financial industry and modern information technology has become increasingly prominent, promoting the popularity of financial engineering. Some universities have also set up special colleges to support the inte-

gration of industry, university and research in related disciplines.

Because the knowledge system of financial engineering is more complex than other similar majors, graduates usually want to continue their studies to master more skills and gain a deeper understanding of the subject, among which postgraduate entrance examinations and overseas study are the two mainstream options. However, in recent years, the high threshold and fierce competition in the financial industry have led to the popularity and difficulty of admission. On the one hand, the number of applicants for the postgraduate entrance examination continues to rise. Although there was a small decline in 2024 (4.38 million), there was still an increase of 51.03% compared with five years ago (2019, 2.90 million). This phenomenon is particularly significant in the application of economic professional masters, especially Master of Finance (MF). Due to the test of mathematical knowledge accounts for a higher proportion, and an increasing number of universities incorporating quantitative finance and financial technology courses in their programs, MF also gets the favor of many students with science and engineering backgrounds, pushing up the score line to a high level. On the other hand, with the lifting of the epidemic prevention and control, the recovery of overseas study has become a popular “alternative” for the postgraduate entrance examination (Zhao, 2023) [1], master programs such as Quantitative Finance, Risk Management that are closely related to financial engineering have become ideal choices for students with science and engineering backgrounds to change their career paths. Faced with the surge in the number of applications, overseas universities are also gradually raising the requirements for applicants’ educational background and language scores. Therefore, under the reality of difficulty in postgraduate admission, it is of great importance for undergraduates majoring in financial engineering to develop proper strategies for time allocation and future planning.

Most of the existing literature, based on the perspective of colleges and universities, provides suggestions for the course construction of financial engineering, such as improving the course system of microfinance and mathematical analysis (Li and Zhang, 2014) [2], strengthening the strategic cooperation with well-known enterprises (Tao, 2016) [3], etc. However, it is also indispensable to provide suggestions from the perspective of students and the core features of financial engineering.

Compared with traditional finance, which focuses on analyzing the operating logic of the economic system, financial engineering attaches more importance to the innovative integration of engineering thinking; compared with financial mathematics, which focuses on optimizing mathematical methods, financial engineering also puts more emphasis on market practice. Therefore, the major aims to foster creative thinking, and cultivate interdisciplinary talents who master financial theory, quantitative skills and investment strategies, among which financial market theory and investment decisions are necessary contents, quantifying skills are important tools, while innovative thinking is the core premise. Scholars have pointed out that no matter in what stage of education, knowledge

mastery, thinking training, and experience accumulation are always the three major elements of cultivating innovation (Shi, 2009) [4]. As undergraduates lack internship or work experience (element 3), the first two elements become particularly important. In other words, in addition to a firm grasp of financial market theories, quantitative skills and investment decision-making methods (element 1), students majoring in financial engineering also need to regularly undergo innovative thinking training (element 2), integrating and applying the knowledge they have learned into their daily practice. This not only helps to expand their minds, but to improve their professional literacy as well. Therefore, when planning for postgraduate admission, can we also internalize the core philosophy contained in professional knowledge and use relevant concepts to solve practical problems? The answer is yes, and this discipline is also applicable to other subjects (Tang, J. and Zou, G., 2023; Ko, C., 2024) [5] [6].

Therefore, this paper attempts to apply the core ideas of professional knowledge in financial engineering in the process of planning for postgraduate admission (mainly from two categories: attitude adjustments and strategy executions), aiming to propose useful suggestions for undergraduates majoring in financial engineering.

2. Methodology

The development structure with theoretical foundation of the article is summarized in Figure 1.

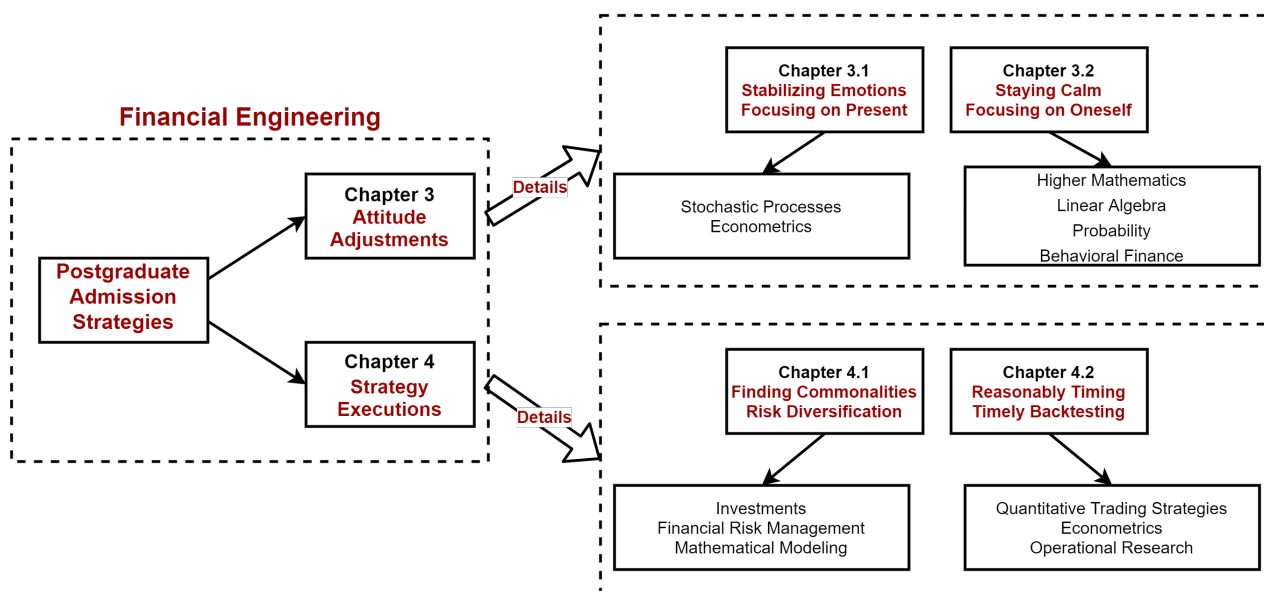


Figure 1. Brief framework.

3. Attitude Adjustments

3.1. Stabilizing Emotions and Focusing on the Present

Markov and martingale processes are the core knowledge points of Stochastic

Processes, and their commonality lies in the fact that the future state of the observed object is only related to the current moment but irrelevant to the past; In Econometrics, only stationary time series can be used to directly construct autoregressive models, with the criterion being that the autocovariance function is stationary, that is, the covariance $Cov(X_t, X_s)$ between two objects is only related to the length of time interval s , but is independent of the specific time t of the observation. During the process of preparing for the postgraduate entrance examination and language exams, students often experience negative emotions such as aversion to learning, lack of confidence, fear of failure, and the desire to give up, which are particularly evident in the middle and later stages, exerting a significant negative impact on the study efficiency. In this case, if one can recall the philosophy contained in the above points, realize that “the past cannot be changed, the future is in the hands of oneself at this moment”, “the accumulated efforts in the previous period will not be wasted only because of the bad performance at time t ”, and “a stable mindset is a key to success”, then he or she can successfully break free from previous negative states, focus on the present without wasting additional time.

3.2. Staying Calm and Focusing on Oneself

The knowledge point of sufficient and necessary conditions first appeared in high school mathematics textbooks and was often involved in the three public compulsory courses of Higher Mathematics, Linear Algebra and Probability Theory. For example, the existence of a limit at a certain point of a function is a sufficient and unnecessary condition for the existence of both limits at a certain point of a function (from Higher Mathematics), “the determinant of the matrix is not 0” is a sufficient and necessary condition for the invertibility of the matrix (from Linear Algebra), and “the correlation coefficient of two random variables is 0” is a necessary and insufficient condition for their independent relationship (from Probability Theory). Theoretically speaking, “sufficient and necessary” reflects the tightest and most complete logical relationship between proposition A and proposition B, “neither sufficient nor unnecessary” is the best state between the exam candidates and the external environment, which means that the candidates can focus on themselves and eliminate the interference of the external environment. This kind of concentration is essential for the exam preparation process. Take the postgraduate entrance examination as an example, before the release of the admission brochure, topics and articles related to a certain major in a certain university will emerge in large numbers, including but not limited to the judgment of enrollment expansion or decrease, the estimate of the number of applicants, etc., and most of them can gain higher attention and reading volume. Although several articles are supported by detailed data and rigorous logic, what they do is only a prediction that cannot determine the final situation. If candidates treat them too seriously, they will exert a great (negative) impact on their mentality. Therefore, it is of great importance for candidates to retain their

own judgment and concentration.

The relevant theories in Behavioral Finance can also provide evidence and support for the above strategies. The efficient markets hypothesis is built on three weakening assumptions (Zhu *et al.*, 2019) [7]: first, investors are rational people, and the market prices fully reflect the intrinsic value of assets; Second, investors have independent irrational biases that offset each other; Finally, although these biases cannot offset each other, they can be eliminated through arbitrage. Based on the above three assumptions, taking the postgraduate entrance examination as an example, we can examine the current market efficiency.

First, in recent years, the number of applicants has continued to rise. Although the growth rate slowed down in 2023 and even became negative in 2024, the trend of returning to the “mean” and “rational” is not obvious, which needs to be further confirmed by combining the data of subsequent years. Therefore, whether the first hypothesis is valid cannot be determined.

Secondly, since the choice for the postgraduate entrance examination can only be one major in one university, the final application status is essentially the result of a psychological “game” among candidates. To be specific, there may be multiple colleges in the same university recruiting MF (the track will be different according to the specific enrollment colleges, for example, the program under the School of Economics is toward financial econometrics, and that under the School of Big Data is toward quantitative investment, etc.). The score lines of different MF tracks are delimited separately, but the test subjects are generally the same, which makes it relatively easy for candidates to switch between tracks. Since individual decisions are not independent, the application heat of each track is difficult to predict. Therefore, it is also impossible to judge whether the second hypothesis is true.

Finally, with the increasing information transparency of the postgraduate entrance examination market, the good cost performance of several majors at the beginning will gradually disappear due to the increase in the number of applicants. This essentially presents an “arbitrage” phenomenon, which is in line with the third hypothesis.

Therefore, to sum up, it can be believed that the current postgraduate entrance examination market has the conditions to become an effective market, in this case, it is not wise to spend a lot of time pursuing “cost-effective” majors. The proper approach for candidates is to make rational applications based on their own situations.

4. Strategy Executions

4.1. Finding Commonalities for Risk Diversification

Portfolio theory is the core of Investments, which points out that if the correlation coefficient between two assets is less than 1, the effect of risk diversification can be produced; In Financial Risk Management, the expected loss caused by credit risk is related to the amount of risk exposure, default probability and de-

fault loss rate ($ES = EAD \times PD \times LGD$). Considering the fierce competition for postgraduate admission, only “putting all your bets” on the postgraduate entrance examination or studying abroad will lead to high opportunity costs and great uncertainty. Therefore, to better diversify the risk, it is possible for students to do preparations for both at the same time since they have similarities and commonalities. This is like investing in two financial assets with a correlation coefficient less than 1 at the same time, in the case of a constant amount of risk exposure (EAD) and uncontrollable default probability (PD), by reducing the default loss rate (LGD), the total expected loss (ES) can also be effectively controlled.

The principle of two-fund separation in Investments can also provide theoretical support for the above strategy: Investors' funds will be weighted between risk-free assets and risky assets. Although the proportion of allocation is affected by investors' own risk aversion, investors' choice of risky assets is the same (all of them will choose the optimal portfolio of risky assets, that is, the tangent point of the capital market line and the efficient boundary curve, with the maximized Sharpe ratio). Therefore, the importance of the common part (the optimal risk asset portfolio) of the postgraduate entrance examination and study abroad is self-evident.

So, what are the common parts of the postgraduate entrance examination and study abroad, and how to prepare for them at the same time? Taking financial engineering as an example, here are four ideas for reference.

First, a qualified language score is the threshold for applying to study abroad, which means that every international student must go through training the ability of listening, speaking, reading and writing, and cultivating a sense of using English. This all-round practice is greatly helpful for preparing for the postgraduate entrance examination. For example, both the writing part of English II (code: 202) and IELTS involve graph analysis; there are some similarities in length and subject of the reading materials between English I (code: 101) and IELTS. Therefore, these highly related items can be prepared at the same time, “killing two birds with one stone”.

Second, in the preliminary examination of MF, Mathematics (code: 303 or 396) and Comprehensive Finance (code: 431) occupy a considerable proportion (60% of the total score), the contents of which are mostly taught in the undergraduate courses of financial engineering. In the application for studying abroad, a high GPA is helpful to enhance the competitiveness of the applicant. Since the core courses of mathematics and finance carry more credits than others, high scores in these courses will significantly improve the final GPA. Therefore, by comparing the commonalities, it is recommended that students use some questions for the postgraduate entrance examination as supplementary exercises after the daily courses. In this way, students can not only learn the content of the postgraduate examination in advance, but also review and strengthen the knowledge points involved in the class, which helps to improve the possibility of ob-

taining a higher course GPA, thus, to help the application for studying abroad.

Third, actively participating in contests related to their major can not only enhance their practical skills, but also improve their competitive advantages in the application for overseas study and the secondary examination for postgraduate studies. Benefiting from the interdisciplinary nature of financial engineering, students can sign up for not only financial competitions (financial technology innovation competitions, securities investment competitions, etc.), but other professional discipline competitions involving mathematics, statistics and computer science as well (such as Mathematical Contest in Modeling (MCM), National College Students Statistical Contest in Modeling, International Collegiate Programming Contest (ICPC), etc.).

Fourth, in the financial industry, most practitioners need to obtain professional certificates to engage in a certain business qualification and prove their professional ability. Therefore, no matter whether studying abroad or taking the postgraduate entrance examination, obtaining a certificate is an indispensable issue. By comparing the knowledge system of certificate examinations and postgraduate entrance examinations, we can find many commonalities between them. To be specific, the following pairs with high correlation are the recommended combination of joint test preparation: 1) *Economics, Corporate Finance, Derivatives, Equity, Portfolio Management, Fixed Income* and other subjects in the Chartered Financial Analyst (CFA) exam correspond to most of the contents in the postgraduate entrance examination; 2) *Financial Markets and Products, Valuation and Risk Models* and other subjects in the Financial Risk Manager (FRM) exam correspond to the parts of financial markets, investments and financial risk management; 3) *Financial Cost Management* of the CPA exam corresponds to the parts of corporate finance and investments; 4) *Basic Knowledge of Financial Market* in the securities qualification examination corresponds to the parts of money, banking and financial markets; 5) *Basic Knowledge of Securities Investment Fund* in the fund qualification examination corresponds to the parts of financial market and investments; 6) *Futures and Derivatives Basis* in the futures qualification examination corresponds to the part of financial engineering.

In addition, it is worth mentioning that in addition to the above-mentioned approaches, students can also give full play to the idea of mathematical modeling (Yue and Zheng, 2013) [8], based on quantitative methods (text mining, clustering, dimensionality reduction, etc.) to compare, analyze and summarize more potential linkages between exams. This ability is also the embodiment of creative thinking (Liu, 2011) [9], conducive to students to truly grasp the spirit of professional knowledge and learn how to make real-world applications.

4.2. Reasonably Timing and Timely Backtesting

In terms of strategy execution, grasping commonalities and managing risks are the core contents, but reasonable timing and timely backtesting are also indis-

pensable. Timing and backtesting are two important processes in the construction of quantitative trading strategies. Under the realistic situation of developing postgraduate admission strategies, the former means adding specific time points to each to-do item (equivalent to upgrading the cross-sectional data in Econometrics to panel data, which helps to improve the clarity and execution of the plan), while the latter refers to regularly check the execution status, affirm achievements, find deficiencies, summarize lessons and dynamically optimize the plan in the future (which contains the idea of Operational Research).

5. Conclusion

This paper implements the core ideas of professional knowledge in financial engineering in the process of planning for postgraduate admission, focusing on two aspects (attitude adjustment and strategy execution) and incorporating various subjects (Stochastic Processes, Econometrics, Probability, Investments, Financial Risk Management, Mathematical Modeling, etc.). Besides, from my perspective, it is recommended that financial engineering undergraduate students personalize their own strategies with the foundation of professional knowledge and their own situations to improve the flexibility of the application.

Conflicts of Interest

The authors declare no conflicts of interest.

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