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THE CQF CAREERS GUIDE TO QUANTITATIVE FINANCE

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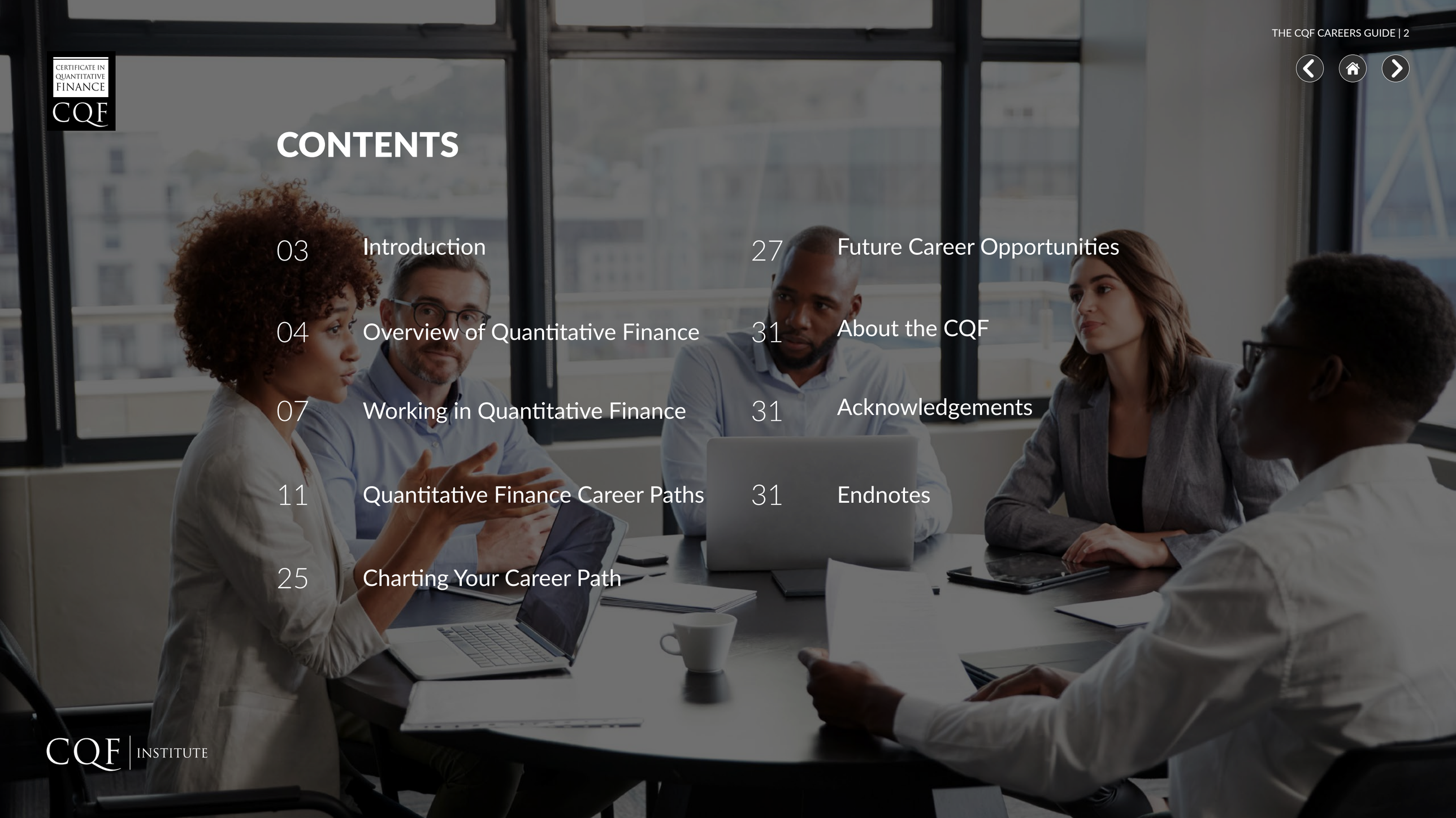

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INTRODUCTION

Quantitative finance arose in the mid to late 20th century as the financial markets evolved and became larger and more complex. Over time, the existing techniques became inadequate for stock selection, asset allocation, managing large volumes of information, valuing abstract financial products, and trading in the global markets on exchanges around the world.

These days, people with quantitative skills are in great demand. Recruiters who specialize in placing quants share the view that 2021 was a very good year and they expect that strong hiring trends will continue across the financial industry, as well as within the ecosystem of tech companies and consulting firms that serve it.

Areas like machine learning, cryptocurrencies, and ESG investing are also drawing on quant talent and the development of new tools, products, and services will provide further opportunities for quants in both the near and long terms.

Produced by the CQF Institute, The CQF Careers Guide to Quantitative Finance is designed for people who are seeking insights on the current state of the industry. The CQF Careers Guide examines the quant landscape through the lens of recruiters, CQF Institute members, and CQF alumni, who offer their comments, stories, and survey responses to develop the picture of quant career opportunities today.

THE GUIDE COVERS SIX CAREER PATHS IN QUANT FINANCE:

- Data Science and Machine Learning
- Portfolio Management
- Risk Management
- Quant Strategies and Research
- Technology
- Quant Trading

In each of these areas, The CQF Careers Guide presents a brief description of the skills needed, typical roles and responsibilities, and general salary ranges based on research from multiple sources including job websites, recruiter interviews, and industry publications. The CQF Careers Guide also looks towards the future and offers a perspective on some of the best ways to prepare for the job opportunities and industry changes that lie ahead.

The CQF Careers Guide also offers commentary on the value of further education. In a highly competitive environment, financial firms are always seeking ways to apply innovative models and methods to generate returns and manage risk effectively. This requires skilled professionals with an understanding of finance, mathematics, and programming. Delivered by Fitch Learning, the Certificate in Quantitative Finance (CQF) is designed to meet this need and is a globally recognized qualification that teaches the cutting-edge quant finance and machine learning techniques financial firms require.

> “The CQF Careers Guide to Quantitative Finance provides insights on six career paths for quants in the most active and exiting areas of the financial markets today. We hope that the Guide will be helpful to you as you evaluate your career options.”
>
> **Dr. Randeep Gug, Managing Director, CQF Institute**

OVERVIEW OF QUANTITATIVE FINANCE

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OVERVIEW OF QUANTITATIVE FINANCE

WHAT IS QUANTITATIVE FINANCE?

Quantitative finance is a branch of investment management that employs mathematical and statistical methods to analyze investment opportunities across a range of asset classes.

Practitioners in quantitative finance (quants) work in equities, fixed income and structured products, commodities, foreign exchange, and all varieties of derivatives. Areas of specialization include asset pricing, trading, hedging, portfolio analysis and optimization, risk management, and regulatory compliance. Quants are also entering the world of artificial intelligence and machine learning, where the demand for data scientists is growing dramatically.

THE STRUCTURE OF THE FINANCIAL INDUSTRY

The quant finance community intersects with many aspects of the investment landscape, whether it is in developing and selling complex derivatives, performing risk analytics, or advising buyers on asset pricing and portfolio allocation. Quants work in a variety of roles in investment banks and asset managers, hedge funds, prop trading firms, insurance companies, technology firms, and consultancies.

Traditional job categories include roles in portfolio management, risk management, research, trading, and technology. In recent years, interest in data science and machine learning has grown significantly, intersecting with each of these categories. The data science revolution has impacts on the technology groups at financial firms, due to the infrastructure, programming support, and data management requirements that are part of a data science and machine learning environment.

A Short Mapping of the Financial Industry

When studying the many facets of the financial industry, one of the most active areas for quants entails investment banks and large asset managers. For these types of employers, a key aspect for job candidates to consider is the division between the “buy side” and the “sell side” – a distinction that places emphasis on similar quantitative skill sets, but with different objectives.

The Buy Side and the Sell Side

The **buy side** is comprised of mutual funds, pension funds, foundations, endowments, and hedge funds (institutional investors), as well as high-net-worth individuals. These entities are focused on investing in securities and managing very large funds or substantial individual or family resources, including those overseen by private wealth managers and family offices.

The **sell side** is comprised of investment banks, market makers, and individuals who develop the products and services that the buy side is seeking. This entails the creation, promotion, and sale of stocks, bonds, foreign exchange, derivatives, structured products, and other financial instruments to the buy side and in the public markets.

The Front, Middle, and Back Offices

Inside these firms, quants are found in the so-called front, middle, and back offices. The front office (FO) is closest to trading and clients, and quants in the FO will often be involved in creating financial products, conducting research, and assisting with portfolio management as it intersects with strategies and trading in the market. The middle office (MO) is focused on supporting the front office directly, including functions of risk management, finance, accounting, model validation, price verification, and compliance. The back office (BO) handles trade processing, clearing, and accounting. The BO also tends to maintain the technology systems that support the firm's activities. Technologists may work in any of these offices, supporting the essential activities within them. Data scientists often work in the research area of the firm and may interact across the offices due to the nature of their work.

Beyond Investment Banks and Asset Managers

Outside of the investment banks and large asset managers, quants will find roles in prop trading firms, where roles in research and trading will be prominent. In insurance companies, they may be involved in portfolio and risk management, and at tech firms and consultancies, there are roles in technology, research, and niche areas, such as alternative data analytics and regulatory tech and compliance.

The emergence of FinTech has created a new set of opportunities for quants, including roles in high-frequency trading, machine learning, cryptocurrencies, and distributed ledger technology, all of which require strong programming skills.

For those seeking a job in quant finance, familiarity with the general industry structures, terminology, and relationships within and between firms can help shape their perspective on where the most desirable opportunities are.

Specific Roles for Quants

Quants work across all areas of finance, and are particularly known for their work in pricing, trading, asset allocation, IT, product development, and risk management. There are quants who work on derivatives pricing models, such as exotic options, and quants who work on structured products ("structurers"). Model validation quants focus on meeting regulatory requirements regarding pricing models, as well as supporting the trading and risk management functions of the firm. Finally, there are quant traders and quants involved in asset management, risk management, investment strategies, quant development, IT, and research. While the financial domain knowledge varies in each of these specializations, the core skills required always entail mathematics and programming as part of the quant package.

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WORKING IN QUANTITATIVE FINANCE

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WORKING IN QUANTITATIVE FINANCE

THE PROFESSIONAL PERSPECTIVE

Quant finance is a demanding field with excellent opportunities for curious, highly motivated people. Roles in quant finance offer good salaries, opportunities for growth, and considerable job satisfaction for people who are interested in applying a technical skill set to the real world of the financial markets.

According to recruiters, the hiring trends for quants are strong, with opportunities ranging from roles in investment banks and asset managers, to hedge funds, prop trading shops, FinTech firms, and consultancies. It is a job candidates' market and a great time to enhance your skills as you explore opportunities across the quant landscape. As part of a complete work search plan, there are several other aspects to consider in the months and years ahead, focused on conditions in the external environment and on the internal motivations and personal factors that go into your career decisions.

Job Confidence

In the *2021 Global Job Confidence Index* from Selby Jennings[1], there was a strong rebound in sentiment about employment in financial services. The report notes, "Overall, the results indicate that confidence in the job market for financial services professionals is at an all-time high, with over 58% feeling either positive or very positive, a predominant spike from only 23% in 2020."

The level of optimism on individual situations was remarkably high, considering the difficulties of the past two years with the pandemic. As the report observes, "The global sentiment in respondents' own job security remains extremely stable, with over half (67%) feeling confident or very confident about keeping their jobs over the next six months."

Psychological and Personal Motivations

Looking at the psychological and personal factors that drive job seekers' actions, the key motivations for finance professionals tend to be salary, career progression, and the need for new challenges, with distinct variations by geographic region. Here, the *Global Job Confidence Index* stated, "In 2021, 69% of North American respondents shared that (seeking a higher salary) was the most important factor motivating their career. In EMEA, the picture is less clear, with respondents almost equally valuing the opportunity to progress (62%) and the desire for higher salary (61%). When we look across the waters to APAC, there is a strong desire for career progression, with 78% saying it was an important motivational factor ahead of a higher salary." For quant finance professionals around the world, these leading factors: higher salaries, opportunities for advancement, and the pursuit of fresh challenges will continue to affect their outlook and efforts in the years to come.

Recruiters emphasize that there is tremendous demand for quants these days, with an inadequate supply of qualified candidates, even in major financial centers like New York, Chicago, and London. Technological and quantitative skills are essential in today's job market and an informed and thoughtful approach to professional development is likely to bear fruit now and in the future.

ESSENTIAL SKILLS IN QUANTITATIVE FINANCE

For those interested in quantitative finance, the essential knowledge covers a wide range of domains. Traditionally, quants of all types needed to have a solid grasp of mathematics and modeling techniques. These days, depending on the role and expected career trajectory, quants are also expected to have a general understanding of the financial markets, intermediate programming skills at a minimum, and an interest in developing specific domain expertise.

In a recent poll conducted by the CQF Institute, 58% of respondents stated that math, finance, and programming are all very important for developing a career in quant finance. Of those polled, 21% felt that math was the most important.

Foundational Skills

In brief, the essential knowledge domains for quant finance can be described as follows:

MATHEMATICAL SKILLS

Quants draw on a variety of mathematical methods, with a focus on probability, statistics, linear algebra, and calculus, including PDEs and SDEs for pricing assets from equities and bonds to structured products and derivatives. Quants also use mathematical techniques and numerical methods to handle special challenges such as modeling volatility and advanced techniques in machine learning.

PROGRAMMING SKILLS

Programming skills have become essential to quants. Traditional programming languages such as C, C++, and C# have been popular for quants historically, and Python has made significant gains in recent years.

In the CQF Institute's Quant Finance Careers Survey, respondents indicated that for the most common computer skills in daily use, Python outpaced other languages by a wide margin (61%).

FINANCIAL SKILLS

Even entry level quants should possess an understanding about the asset classes and financial products they will be working with at their firm. They should also have some knowledge of the financial markets, including the buy side, the sell side, and the types of market participants that are found in their area of the industry. They also need product knowledge of areas such as asset pricing, trading, investment strategies, portfolio management, and risk management. Although on-the-job training is quite common at the largest financial firms, understanding the basics of how the industry works is useful.

PREPARING FOR JOB INTERVIEWS

Since quant finance is an intellectually demanding field, employers will typically test a candidate's knowledge and skills quite rigorously throughout the interview process. Financial problems, math brainteasers, and programming samples are often part of the journey. When preparing for an interview, it is good practice to review your knowledge and skills, study the types of questions likely to be posed to you, and research the company carefully. In addition, you may wish to look up the person with whom you will be interviewing on the firm's website and LinkedIn.

Ahead of the interview, prepare for various types of conversations, including brainteasers, knowledge tests, and thinking under time pressure. A few good resources for quant interviews include *Heard on The Street: Quantitative Questions from Wall Street Job Interviews*, by Timothy Falcon Crack, *Quant Job Interview Questions and Answers*, by Mark S. Joshi, Nick Denson, and Andrew Downes, *150 Most Frequently Asked Questions on Quant Interviews*, by Dan Stefanica, Radoš Radoičić, and Tai-Ho Wang, and *Frequently Asked Questions in Quantitative Finance*, by Paul Wilmott.

In CQF Institute's Quant Finance Careers Survey, 89% of respondents stated that it is important to have a professional qualification when seeking a career in quant finance.

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QUANTITATIVE FINANCE CAREER PATHS

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QUANTITATIVE FINANCE CAREER PATHS

This section of The CQF Careers Guide outlines six different career paths in quantitative finance:

- DATA SCIENCE AND MACHINE LEARNING
- PORTFOLIO MANAGEMENT
- RISK MANAGEMENT
- TECHNOLOGY
- QUANT STRATEGIES AND RESEARCH
- QUANT TRADING

Each career path presents a brief description of the typical roles and responsibilities, with specific examples by job title.

DATA SCIENCE AND MACHINE LEARNING

Professionals working in data science and machine learning are responsible for research, modeling, and testing. They work with data sets to uncover relationships and patterns in empirical data.

Skills for Data Science and Machine Learning

Professionals working in this area need to have a deep understanding of algorithms, machine learning, and specific domains such as natural language or signal processing to help identify and assess patterns in the data. They have strong quantitative analysis skills and a solid understanding of artificial intelligence and machine learning techniques, as well as familiarity with the programing languages commonly used in machine learning such as Python.

Roles for quants in data science and machine learning require significant knowledge of models and programming. These jobs tend to sit within the research area of an organization. Firms that are active in data science and machine learning include investment banks, asset managers, hedge funds, and technology firms that offer consulting services to the financial industry. There are also many opportunities for quants in pure tech firms that develop software products for the financial industry.

Typical Job Areas

DATA SCIENTIST

The role of a data scientist draws on a combination of technical roles, including statistician, scientist, mathematician, and computer programmer. The job entails collecting, cleaning, analyzing, and interpreting vast data sets through predictive modeling and machine learning techniques to detect patterns, trends, and relationships in data sets.

DATA ENGINEER

Data engineers build systems that collect, manage, validate, and convert raw data into high-quality, usable information for data scientists to study.

DATA ANALYST

Data analysts use descriptive statistics to evaluate problems, create data visualizations, and develop insights based on empirical analysis. They may assist with collecting and cleaning data sets and supporting the senior members of the data science team.

Compensation (in USD)

DATA SCIENCE AND MACHINE LEARNING

INVESTMENT BANK

	North America		Europe		Asia	
	Base	**Total Comp**	**Base**	**Total Comp**	**Base**	**Total Comp**
Data Analyst Associate	$70,000 - $90,000	$80,000 - $108,000	$53,000 - $79,000	$61,000 - $95,000	$47,000 - $70,000	$51,000 - $77,000
Data Scientist VP	$90,000 - $150,000	$117,000 - $225,000	$66,000 - $92,000	$86,000 - $139,000	$72,000 - $104,000	$79,000 - $114,000
Data Scientist Senior VP/Director	$150,000 - $250,000	$210,000 - $450,000	$106,000 - $119,000	$148,000 - $214,000	$104,000 - $195,000	$114,000 - $208,000

DATA SCIENCE AND MACHINE LEARNING

Career Journey

Spencer Cavallo (Portfolio Construction and Investment Research) studied math and economics at university before starting a role in derivatives pricing and risk models. After four years, he transitioned into a role in portfolio construction and investment research. In this role, he was passionate about finding ways to incorporate machine learning and data analytics into his firm's research process. As he explored opportunities to expand his education on these topics, he was attracted to the CQF's blend of financial engineering and machine learning content and decided to enroll on the program.

> "As we moved into the machine learning section, I became intrigued by the potential applications to my role. I decided early on that I would concentrate on machine learning for my final CQF project so that I could delve deeper into the subject."
>
> Spencer Cavallo
> (Portfolio Construction and Investment Research)

DAILY TASKS

According to the Quant Finance Careers Survey conducted by the CQF Institute, for people working in data science, 76% of their daily tasks involve data analysis, research, modeling, and coding. This path is heavily dependent on good programming skills and job seekers should possess a solid understanding of the tools and techniques of machine learning.

CQF CORNER

With modules on Data Science and Machine Learning, the CQF program gives delegates the experience of analyzing and interpreting vast data sets using predictive modeling and machine learning methods. Python Labs also offer delegates a chance to practice implementing a range of Python programming techniques.

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PORTFOLIO MANAGEMENT

Professionals working in portfolio management are responsible for asset allocation and portfolio construction. They initiate trades and monitor portfolios and their exposures carefully.

Skills for Portfolio Management

Quants in portfolio management will have strong quantitative and mathematical modeling, coding, and analytical thinking skills. They also have a deep understanding of the various asset classes and a strong, clear communication style. They also tend to have good people skills, as their role may entail direct interactions with clients, which includes handling requests, observing pre-trade client guideline compliance, and addressing tax and other management issues. They must possess extensive knowledge of the firm's investment products as well as products that are available in the broader financial market. They should have a broad knowledge of markets, macroeconomics, and portfolio theory, such as Markowitz, CAPM, APT, and Black-Litterman. Many people on this path begin their careers as portfolio analysts, and some will progress to managing teams of analysts and researchers.

Typical Job Areas

PORTFOLIO ANALYST

Portfolio analysts conduct in-depth portfolio analysis, encompassing asset class and industry knowledge, insights on historic trends in the markets, and an understanding of financial metrics and regulatory and legal restrictions that may affect the portfolio. Portfolio analysts communicate with portfolio managers, as well as trading, risk, and compliance teams. They may also make presentations to clients.

QUANTITATIVE ANALYST

Quantitative analysts use a range of techniques to price assets, manage risk, and identify investment opportunities.

Quant analysts work in the front, middle, and back offices at an investment firm, asset manager, or hedge fund, with the front office being closer to the clients and trading, the middle office working on risk management and model validation, and the back office being focused on clearing, and compliance.

QUANT PORTFOLIO MANAGER

Quant portfolio managers focus on the use of quantitative investment strategies to manage portfolios for institutional and retail investors. They develop statistical and mathematical models to analyze empirical data, searching for patterns and insights to inform the investment decision-making process.

Compensation (in USD)

PORTFOLIO MANAGEMENT

INVESTMENT BANK

	North America		Europe		Asia	
	Base	**Total Comp**	**Base**	**Total Comp**	**Base**	**Total Comp**
Portfolio Analyst Associate	$125,000 - $160,000	$185,000 - $260,000	$99,000 - $125,000	$112,000 - $158,000	$85,000 - $95,000	$135,000 - $145,000
Portfolio Manager VP	$175,000 - $225,000	$300,000 - $500,000	$132,000 - $198,000	$158,000 - $264,000	$145,000 - $155,000	$225,000 - $250,000
Portfolio Manager Senior VP / Director	$240,000 - $300,000	$550,000 - $700,000	$211,000 - $290,000	$264,000 - $528,000	$215,000 - $250,000	$325,000 - $375,000

PORTFOLIO MANAGEMENT

Career Journey

Jean-Paul Jaegers (Head of Asset Allocation) started his career in Multi-Asset Solutions. After 10 years in asset management, he then accepted a job at an insurance company, before moving into wealth management. He now leads a team responsible for the strategic asset allocation and tactical allocation for all multi-asset funds and accounts. In each of his roles, he worked with highly technical teams and his curiosity was triggered to properly understand the pricing mechanisms and algorithms behind the products he worked with. That is when he decided to earn the CQF. The program gave him the chance to learn from industry practitioners and improve his quant skills whilst working full-time.

> "The CQF faculty provided great insights and the assignments were practical; you could apply what you had learned in real market situations later on."
>
> Jean-Paul Jaegers (Head of Asset Allocation)

DAILY TASKS

In the CQF Institute's Quant Finance Careers Survey, for respondents working in portfolio management, portfolio monitoring, research, data analysis, modeling, and market monitoring were said to comprise 68% of the daily tasks.

CQF CORNER

The CQF program gives delegates a strong understanding of asset allocation and portfolio construction, covering everything from modern portfolio theory and the capital asset pricing model to advanced portfolio management techniques.

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RISK MANAGEMENT

Professionals working in the risk management path support the investment decision-making process through risk analysis and the creation of risk model frameworks for specific assets and asset classes.

Skills for Risk Management

Quants working in risk management possess strong quantitative and financial modeling skills and have proficiency with programming in Python or R, for example. They have knowledge of various methods including "Value-at-Risk" (VaR and its variants), statistical models, and simulations to evaluate the risk exposure for an asset or across an entire portfolio of assets. They require knowledge of stochastic calculus, Monte Carlo, PDEs, and other numerical techniques. They need to have familiarity with financial markets, including the most recent regulatory developments. In recent years, there has been a strong emphasis on regulatory compliance and stress testing since the Global Financial Crisis and risk managers are often engaged in model testing and validation. Quants in risk management tend to have good communication skills and maintain focus on details and compliance.

Typical Job Areas

RISK ANALYST

A risk analyst evaluates individual assets, portfolios, and external industry and economic conditions to help firms make risk-aware investment decisions.

RISK MANAGER

Risk managers use data analytics and mathematical models to evaluate the risk profiles of financial instruments and portfolios, measuring the changes to those profiles over time. They are responsible for risk reporting internally to senior management and externally to regulators.

MODEL VALIDATION QUANT

Model validators work with models and methods developed by front office quants to assess their validity and mitigate the existence of model risk. Since the Global Financial Crisis, regulators often interact directly with quants in the middle office, including model validators. This area of quant finance has grown significantly in recent years. Responsibilities may include collaborating with counterpart quant analysts who develop the pricing models that will need validation, writing technical reports, providing quantitative analysis and model documentation, and maintaining tools such as programming libraries and test environments that support the validation process.

Compensation (in USD)

RISK MANAGEMENT

INVESTMENT BANK

	North America		Europe		Asia	
	Base	**Total Comp**	**Base**	**Total Comp**	**Base**	**Total Comp**
Risk Analyst Associate	$60,000 - $90,000	$66,000 - $99,000	$46,000 - $66,000	$50,000 - $73,000	$52,000 - $78,000	$57,000 - $86,000
Risk Manager VP	$90,000 - $150,000	$99,000 - $165,000	$66,000 - $145,000	$73,000 - $160,000	$72,000 - $130,000	$79,000 - $130,000
Risk Manager Senior VP / Director	$150,000 - $190,000	$172,000 - $218,000	$132,000 - $185,000	$152,000 - $213,000	$101,000 - $234,000	$117,000 - $351,000

RISK MANAGEMENT

Career Journey

Mukund Javeri (AVP, Market Risk Management) began his professional life in enterprise risk management, having an undergraduate degree in accounting and a master's in finance. Following his completion of the CQF program, he moved into management, dealing with pricing concepts and treasury.

> "Most senior managers in risk were actually front office traders previously, and since that is not my own background, the CQF has opened doors. Looking into the future, I have several career options: developing pricing methodologies and tools; working in risk methodology because that also focuses on quantitative finance and pricing assumptions or becoming a pure market risk manager dealing with trading teams. Any of these choices would be a good fit and, as I just completed the program in 2020, my evolution in risk management is ongoing."
>
> Mukund Javeri (AVP, Market Risk Management)

DAILY TASKS

According to the CQF Institute's Quant Finance Careers Survey, for people in risk management, over half of daily tasks (55%) involve modeling, data analysis, and coding. An additional 20% of their time is spent on research and team management.

CQF CORNER

The CQF program helps delegates build knowledge of risk models and analytical practices and covers a range of methods such as VaR and its variants, Monte Carlo simulation, time series analysis, stress testing, and statistical models.

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TECHNOLOGY

Quant professionals working in technology design, develop, and implement software solutions to support various departments across the firm.

Skills for Technology

Quants in technology will have excellent coding skills in Python, C, C++, or C#, for example. They should also have a good understanding of computational mathematics, probability, linear regression, and time series data analysis as applied in the financial context. They tend to work on projects with a number of teams if they are in a large organization, so having domain expertise combined with good skills in collaboration and communication will be helpful.

Typical Job Areas

QUANT DEVELOPER

Quantitative developers, also known as quantitative software engineers, or quantitative engineers, develop, implement, and maintain quantitative models. They are highly skilled programmers, specialized in languages like Python or C, C++, and its variants, and they often work at the intersection between software engineers and quantitative analysts. Typical responsibilities may include developing and maintaining programing libraries, developing high-performance numerical library components, performance tuning of libraries, and consulting on high-performance computing, optimization, and strategy.

Compensation (in USD)

TECHNOLOGY

	North America		Europe		Asia	
	Base	**Total Comp**	**Base**	**Total Comp**	**Base**	**Total Comp**
Quant Developer Associate	$120,000 - $140,000	$132,000 - $154,000	$119,000 - $132,000	$131,000 - $145,000	$31,000 - $55,000	$34,000 - $60,000
Quant Developer VP	$180,000 - $210,000	$230,000 - $260,000	$185,000 - $211,000	$238,000 - $264,000	$59,000 - $85,000	$64,000 - $93,000
Quant Developer Senior VP / Director	$220,000 - $250,000	$270,000 - $300,000	$224,000 - $251,000	$277,000 - $304,000	$98,000 - $156,000	$107,000 - $169,000

TECHNOLOGY

Career Journey

Marcin Borratyński (Head of Quant IT) studied computer science at university, before starting an internship in data analysis at one of the world's largest centers for scientific research. He later moved to the company's pension fund where he was given an interesting project to build a new IT infrastructure for the fund. As the project developed year by year, Marcin felt he needed to delve deeper into quantitative finance so enrolled on the CQF. The program gave him the tools and insights to develop many ideas that he could put into practice at work.

> "The CQF gave a nice overview of different tools using quantitative finance and helped me to develop practical things for the fund; everything I was doing on the CQF was actually running in parallel with my efforts to build a quantitative strategy for the pension fund."
>
> Marcin Borratyński (Head of Quant IT)

DAILY TASKS

According to the CQF Institute's Quant Finance Careers Survey, for those in technology, over 60% of respondents' time is spent on core tasks like coding, data analysis, and modeling, while a further 21% of their time is spent on research and team management.

CQF CORNER

With online Python Labs, as well as advanced electives on C++ and FinTech, the CQF program helps delegates develop excellent coding skills in Python so that they are able to build, implement, and analyze quantitative models used in technology roles.

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QUANT STRATEGIES AND RESEARCH

Professionals working in quant strategies and research often use quantitative and statistical methods to analyze the markets, and then generate and test ideas for investment strategies. These quants focus on mathematical models, with the potential to generate alpha, while also managing risk effectively.

Skills for Quant Strategies and Research

Quants working in strategies and research will have a detailed knowledge of mathematical and statistical models used in quant finance. They also require knowledge of financial mathematics and stochastic calculus. They will have good programming skills in Python or C++, for example, and may have skills in R, MATLAB, or SAS as well. Knowledge of machine learning and natural language processing techniques is increasingly in demand for quant research and analysis.

Typical Job Areas

QUANT RESEARCHER

A quant researcher develops and implements pricing models and trading strategies and analyzes existing strategies to identify potential improvements. Quant researchers also create tools to automate research tasks and visualize the information found in complex data sets. Responsibilities may include working on strategy research, back testing models, execution, latency strategy research, machine learning research, econometrics research, and market microstructure research.

QUANT STRATEGIST

Quant strategists research and implement trading strategies, using pricing and trading models.

They also develop risk models to manage portfolio risks and analyze current strategies to identify issues and make improvements. They often work with traders, quant analysts, software engineers, and quant developers. Responsibilities include analyzing trading and asset allocation opportunities and working with a comprehensive set of risk reporting and pricing tools.

DERIVATIVES ANALYST

A derivatives analyst applies mathematical formulas and computer algorithms to evaluate financial data, detect investment trends, and recommend asset allocation strategies. A derivatives analyst may also evaluate transactions from risk management and legal standpoints to ensure compliance with regulatory requirements.

Compensation (in USD)

QUANT STRATEGIES AND RESEARCH

BUY SIDE

	North America		Europe		Asia	
	Base	**Total Comp**	**Base**	**Total Comp**	**Base**	**Total Comp**
Quant Researcher Associate	$150,000 - $200,000	$250,000 - $500,000	$106,000 - $132,000	$132,000 - $396,000	$95,000 - $105,000	$165,000 - $185,000
Quant Researcher VP	$175,000 - $250,000	$400,000 - $750,000	$119,000 - $152,000	$198,000 - $594,000	$170,000 - $180,000	$250,000 - $275,000
Quant Researcher Senior VP / Director	$250,000 - $300,000	$750,000 - $1,200,000	$132,000 - $198,000	$264,000 - $792,000	$225,000 - $250,000	$400,000 - $500,000

QUANT STRATEGIES AND RESEARCH

Career Journey

Leticia Mortoza (Senior Quant) studied economics followed by a master's degree in finance, an MBA in financial engineering, and a PhD in electrical engineering. This allowed her to pursue many quantitative roles around the world. However, she still felt like she needed to enhance her practical quantitative skills so enrolled on the CQF. She enjoyed the modules very much and for her final CQF project, priced a N-th to Default CDS Basket which helped her in one of her roles as she was able to get some model validation time-sensitive work done quickly.

> "The CQF was clearly a very practical approach to learning, it was part-time, complementary to my work schedule, and could be completed in 6 months."
>
> Leticia Mortoza (Senior Quant)

DAILY TASKS

In quant strategies and research, respondents to the Quant Finance Careers Survey conducted by the CQF Institute stated that 63% of their daily tasks involve research, data analysis, modeling, and coding.

CQF CORNER

The CQF program gives delegates a strong understanding of the mathematical and statistical models, and machine learning techniques needed to work in quant research and analysis.

www.cqf.com

QUANT TRADING

Professionals working in quant trading employ mathematical and statistical models to identify potentially profitable trading strategies and to execute trades. They develop strategies and then focus on back testing, analysis, and optimization. Quant traders may be involved in statistical arbitrage, algorithmic trading, and high-frequency trading.

Skills for Quant Trading

Quant traders must have deep knowledge of quantitative and statistical analysis as well as strong programming skills in Python or C++, for example. They may have experience with machine learning techniques as well. Psychology is very important for quant traders and trading job candidates must demonstrate that they thrive in extremely competitive environments and can handle pressure well.

Typical Job Areas

QUANT TRADER

Quant traders trade a variety of asset classes, including equities, bonds, commodities, currencies, and derivatives using a combination of market knowledge, trading experience, and math and computer skills. Quant traders work at investment firms, hedge funds, and banks; they may also be proprietary ("prop") traders working in small groups within such organizations, or independently for their own accounts.

Compensation (in USD)

QUANT TRADING

	North America		Europe		Asia	
	Base	**Total Comp**	**Base**	**Total Comp**	**Base**	**Total Comp**
Quant Trader Junior Trader	$100,000 - $115,000	$125,000 - $170,000	$105,000 - $130,000	$140,000 - $205,000	$70,000 - $120,000	$120,000 - $225,000
Quant Trader Senior Trader	$115,000 - $250,000	Base + 30-50% of PnL	$130,000 - $210,000	Base + 10-40% of PnL	$150,000 - $170,000	Base + 10-40% of PnL
Quant Trader Head of Trading	$240,000 - $300,000	Base + 30-50% of PnL	$210,000 - $290,000	Base + 10-40% of PnL	$215,000 - $250,000	Base + 10-40% of PnL

QUANT TRADING

Career Journey

Joy Tolia (FX Trader) studied pure mathematics at university. Once he started his career, he realized he needed to bridge the gap between the theory he had learned at university and the practical application of quantitative skills used in industry. He enrolled on the CQF and the program gave him the chance to learn more about core mathematical techniques, understand different asset classes, and get to grips with more complicated theory used in the financial markets.

> "I found the CQF assignments helpful for my learning and the final CQF project allowed me to specialize further."
>
> Joy Tolia (FX Trader)

DAILY TASKS

According to the CQF Institute's Quant Finance Careers Survey, for those in trading, 55% of their time spent on daily tasks involves coding, data analysis, and modeling. An additional 13% of their time is spent on trade execution.

CQF CORNER

The CQF program teaches the mathematical models traders need to price assets, manage risk, predict market movements, implement algo trading strategies, and find arbitrage opportunities.

www.cqf.com

CHARTING YOUR CAREER PATH

CHARTING YOUR CAREER PATH

As we have seen, in each of the six job categories discussed, there is a strong emphasis on quantitative and analytical skills, technical expertise, and knowledge of specialized areas of finance. Some roles require strong communication skills and entail a significant amount of interaction with internal and external clients. A challenging and satisfying career in quant finance depends on the ability to adapt to changing conditions in the financial markets and the desire to improve on one's skill set and perspective continuously. The following section addresses additional considerations for your career.

THE BUSINESS SKILLS: COMMUNICATION AND COLLABORATION

In order to advance through the ranks of either a financial or a technology-focused firm, an employee needs to develop domain expertise and demonstrate consistent high-quality performance. Recruiters advise that soft skills such as communication (both verbal and written), collaboration, and empathy become increasingly important when working in larger teams or moving into managerial roles. A quant can be a strong individual contributor and highly effective at managing projects, which can also lead to career advancement. Those who are able to manage people well may move into senior executive roles.

> Respondents to a recent poll conducted by the CQF Institute concur: 76% felt that a combination of communication, collaboration, and leadership were most important for career progression in finance, as opposed to favoring a single one of those options over the others. Further, 74% stated that networking plays an important or very important role in developing a career in quant finance.

FROM START-UPS TO MULTINATIONALS: COMPANY SIZE MATTERS

When plotting the course for your career, the size of firm under consideration also matters. In small start-ups, there can be considerable mobility, especially for people who do well with uncertainty, are self-starters, and eager to learn new things. Hedge funds also tend to have fairly small teams, from 2-3 people to several 100 people for the larger funds. However, even the largest hedge funds do not employ more than a few thousand people; In contrast, institutional asset managers and investment banks may have tens of thousands of employees.

The dynamics within the firms at these scales will tend to be quite different and it is wise for prospective employees to understand where they will fit in well and what types of work environments are most appealing to them. At small firms, there may be opportunities for rapid advancement, but lower initial salaries than those offered by investment banks or large asset managers. However, equity options may be part of the total compensation package, and can kick in later if the firm is destined to go public. At larger firms, there will tend to be greater predictability in job roles and career progression will be more clearly elaborated.

Quantitative finance is a broad subject, recruiters note, and compensation schemes vary by the type of employer and the job category. If you go to an investment bank or hedge fund, you will find people who come from fairly similar backgrounds from a quant perspective, but they have moved into different types of roles. For some people, there will be a standard base salary and a bonus, but for roles in trading, the bonus compensation is directly linked to trading performance as reflected in the profit and loss (PnL) statement, rather than a percentage of base. So, in addition to thinking about the size and type of firm you are interested in, it is also important to do your research on compensation norms and structures.

FUTURE CAREER OPPORTUNITIES

FUTURE CAREER OPPORTUNITIES

Looking across the financial industry – some of the key themes in quant finance remain the same as they have been for decades, while others are emerging in response to technological change. Exploring the landscape and researching these areas in depth is the foundation for a productive job search.

> “Job candidates need to take a lot more control over their own destiny. Speak to recruiters and to your existing contacts well before you graduate. Be strategic and have a plan about how to prepare for interviews as you work through to getting the job. The market is highly competitive and preparing correctly is crucial.”
>
> Richard Booty of recruiting firm Testwood Partners

EMERGING OPPORTUNITIES IN THE JOB MARKET TODAY

In addition to the typical quant roles discussed, there are opportunities in new and emerging areas for quants, including quantum computing, cryptocurrencies, machine learning, and ESG investing. In these areas, strong quant credentials are in demand and job candidates should take time to educate themselves about the specific trends and roles involved. Overall, recruiters are very positive about upskilling and the value of a good quant education, no matter what corner of the quant world you are exploring.

In a poll conducted at the October 2021 Quant Insights Conference, 81% stated that career opportunities in general will increase for quants in the next five years.

However, in order to take advantage of the changing financial and technological landscapes, quants themselves must evolve: 92% of respondents said that the skill sets needed by quants will continue to change in the near term.

MACHINE LEARNING AND DATA SCIENCE

Over the past decade, interest in machine learning in its various forms has risen dramatically. In quant finance, machine learning plays a role in valuation, asset allocation, risk management, trading, and compliance. Machine learning can handle vast data sets, global news, and visual data to seek out patterns that may be insightful and profitable when applied to trading. Further, it can be put to work in areas that are practically impenetrable for humans alone, including unstructured data, alterative data sets, and multi-factor analysis.

As data science has become more prominent in the investment world, the CQF has been extended to provide a strong foundation in the core principles and techniques, including supervised, unsupervised, and reinforcement learning, deep learning, neural nets, NLP, and algorithmic trading.

> “In terms of the evolution of quant skills, data science and machine learning and Python are getting a lot of attention now. Work in R is dying out and Python is on the rise rapidly. There’s also been a resurgence of C#, which tends to be in the application of trading strategies.
> The core mathematical skills are also one of the biggest drivers for quant hiring and something that we see across the board.”
>
> James Holland of Quant Capital

When asked in a recent poll at an event held by the CQF Institute, 46% of respondents stated that they believed data science and machine learning would provide the greatest career opportunities in the next five years.

ESG INVESTING

ESG investing takes environmental, social, and governance factors into consideration when making investment decisions. Asset classes of interest in ESG include equities, fixed income, including green bonds, and exchange-traded funds. ESG scoring methodologies are in active development these days, and there are opportunities for quants in ESG portfolio management, risk management, research, and analysis.

In a recent poll conducted by the CQF Institute, 22% stated that ESG would be one of the most promising areas for career opportunities for quants.

CRYPTOCURRENCIES

Other niche areas for quants include cryptocurrencies, with opportunities ranging from start-ups to large investment banks. Quant finance has a firm foundation in the use of models, theories, and proofs, essentially moving from abstraction to action. The emergence of digital currencies has increased the demand for asset pricing, hedging, and market analysis.

> “Crypto is the hottest part of the market right now, and FinTech in general has been attracting more and more of talent from traditional finance. Institutional players are pushing into this asset class and service providers are scaling the infrastructure required to support it. Every area from credit, market, and operational risk, as well as sales, trading, research, and overall analytics and automation requirements are attracting quants and developers even if they don’t have prior hands-on experience with digital assets. The demand has far outstripped the supply of talent with direct crypto experience.”
>
> Dennis Grady of executive search firm Spire Search Partners

QUANTUM COMPUTING

New areas in technology include quantum computing (QC) as the latest form of high-performance computing. Research initiatives are underway in many large financial firms, as well as many QC start-ups and consultancies to develop this technology for practical use. Job titles in this field include quantum researcher, quantum developer, and quantum information scientist.

The CQF program contains lectures on quantum computing and there are several sources for further information including books, conferences, and quantum computing websites that provide access to QC programming information and developer kits.

At a recent CQF Institute event, in a poll concerning emerging technologies, 38% of respondents stated that quantum computing would provide the most career opportunities in the next five years.

CONCLUSION

In addition to the typical quant roles discussed in-depth in The CQF Careers Guide to Quantitative Finance, there are clearly opportunities in emerging areas as well. In times of turbulence in the markets, opportunities for quants abound. By taking time to refresh and develop skills in the essential quant domains: math, finance, and programming, job candidates can shape their prospects and paths to meet the changes and challenges in an evolving world. While the future is uncertain, further education in quantitative finance is a wise investment to help you attain your professional goals throughout your career.

ABOUT THE CQF

The Certificate in Quantitative Finance (CQF) is the world's largest professional qualification in quant finance. Awarded by the CQF Institute and exclusively delivered by Fitch Learning, the program is delivered online, part-time over six months, with up to three years to complete all modules and the final project. The CQF focuses on teaching the essential quantitative finance and machine learning skills used by practitioners in today's financial markets. The syllabus is updated quarterly in consultation with faculty and senior alumni to ensure that the skills taught on the program are meeting industry demand. CQF alumni are given permanent access to the CQF Lifelong Learning library to help them keep their skills competitive throughout their careers.

To learn more about the CQF, please visit us at: **www.cqf.com**

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ENDNOTES

CQF Institute resources include polling data from the Quant Insights Conference hosted by the CQF Institute, October 2021, the CQF Institute's Quant Finance Careers Survey, December 2021, and a poll conducted at a CQF Institute talk, February 2022.

Salary table sources include eFinancial Careers, Octavius Finance, Robert Walters, Argyll Scott Technology and Data Analytics Top Skills Report 2021, and Selby Jennings Quant Global Market Report 2021.

[1] Global Job Confidence Index 2021, Selby Jennings (page 8 of The CQF Careers Guide)

CERTIFICATE IN QUANTITATIVE FINANCE

www.cqf.com

UNITED STATES, CANADA:

Tim Johnson

tim.johnson@fitchlearning.com

+1 646 943 6210

ASIA PACIFIC AND INDIA:

Ravinder Panmati

ravinder.panmati@fitchlearning.com

+65 6572 9412

UNITED KINGDOM:

Sophie Shepherd

sophie.shepherd@fitchlearning.com

+44 (0)20 7496 8620

SOUTH AND CENTRAL AMERICA:

Pablo Castro

pablo.castro@fitchlearning.com

+1 646 943 6208

EUROPE, MIDDLE EAST AND AFRICA:

Kevin Brind

kevin.brind@fitchlearning.com

+44 (0)20 7496 8422

www.cqf.com/linkedin

www.cqf.com/twitter

www.cqf.com/youtube

55 Mark Lane, London, EC3R 7NE

33 Whitehall Street, 18th Floor, New York, NY 10004

One Raffles Quay, #22-11, South Tower, Singapore 048583

19/F Man Yee Building, 68 Des Voeux Road Central, Hong Kong

Dubai International Financial Centre, Al Fattan Currency House, Tower 2, Level 8, Office No. 804, PO Box 482058

www.fitchlearning.com

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