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A well-functioning financial system, including its legal and accounting components, is a key driver for realising the long-term growth and development potential of an economy. This conclusion emerges from a variety of studies, including cross-country comparisons, firm-level studies, time-series research and econometric investigations that use panel techniques. A number of economic historians have concluded that those regions – be they cities, states or countries – that developed relatively more sophisticated and well-functioning financial systems were the ones that were also the subsequent leaders in economic development of their times.

New financial product and market designs, improved computer and telecommunications technology and advances in the science of finance during the past 35 years have led to dramatic and rapid global changes in the structure of the financial system. The scientific breakthroughs in finance during this period both shaped and were shaped by the extraordinary flow of financial innovation, which coincided with those changes. The cumulative impact has significantly affected all of us – as users, producers or overseers of the financial system.

Finance science has informed practice across a wide spectrum, with powerful prescriptions for portfolio allocation, asset pricing, performance measurement, risk management and corporate financial decision-making. But surely the prime exemplifying case is the development, refinement and broad-based adoption of derivative securities such as futures, options, swaps and other contractual agreements. It is estimated that more than USD 500 trillion – half a quadrillion – of derivatives are outstanding today globally (in notional terms).

Practitioner innovations in these financial-contracting technologies have improved efficiency by expanding opportunities for risk sharing, lowering transaction costs and reducing information and agency costs.

It was my great good fortune to be involved at the outset of this extraordinary period of development in finance science and the financial system. In 1973, when the late Fischer Black, Myron Scholes and I published the research on option pricing named by me and known as the Black-Scholes-Merton model – which was recognised a quarter century later in Stockholm – options and derivative securities generally were seen as an arcane and specialised area of finance.

The modern financial derivatives markets were then in their infancy. The Chicago Board Options Exchange, the first options exchange, had just been launched; the first financial futures contracts were trading in the Midwest; and the first interest-rate swap contract was still eight years away into the future. Neither Eurex nor the International Securities Exchange (ISE) was yet in existence. At the time there was surely scepticism about the market's potential and considerable doubt over whether the instruments then being developed would prove beneficial.

The methodology for valuing derivatives we had developed not only enabled listed, over-the-counter and executive stock options to be priced, but it also gave us insights into solving a wide range of other structurally equivalent valuation problems, such as a unified theory for pricing corporate liabilities; mortgage prepayment options; offshore oil drilling rights; real estate and movie right options; loan guarantees; deposit insurance; farm price supports; drug discovery phasing; shelf-space in supermarkets; modularity in production and multiple-fuel power plants; indeed even tenure contracts for professors. A whole world of possibilities had opened up.

Although we recognised in the early days that the approach we had developed had wide-ranging application, we could not have forecast the extraordinary speed, breadth and magnitude of the subsequent adoption and development of the derivative markets.

In addition to improving the means to price options, our analysis provided a means of measuring their risk exposure. The methodology also filled a need – with the creation of an options exchange, the pace and scale of trading were such that options traders and market makers could no longer operate based on simple heuristics and guesswork. The 'theory' enabled options traders to take much bigger positions because they could use the model to figure out how to hedge their exposures; they could

be much more efficient and they could control their risk much better.

It was an enormous kick to see how this highly mathematical and abstract theory was put to mainstream practical use – and it has been extraordinarily gratifying to watch its usage extend and the financial derivatives markets develop. Computational and telecommunications technology has been an equally important catalyst for the markets' development. It powers the financial markets, providing access to traders and trading interests around the globe. It has democratised, improved, enhanced and empowered the financial marketplace. It has reduced costs dramatically, enhanced competition, increased transparency and driven a multitude of efficiencies.

This technology has also helped fuel the development of new kinds of trading mechanics, such as the algorithmic trading strategies deployed on the electronic marketplaces. It has supported product development, given birth to a new type of trader and has allowed once esoteric complex products to become liquidly traded assets.

The revolutionising effect of technology is clearly evidenced in the emergence of new financial marketplaces, such as the then Deutsche Terminbörse (the DTB, now Eurex) and ISE, whose histories are outlined in detail in this book.

The impact of those two pioneering electronic marketplaces cannot be underestimated; since the DTB erupted onto the European scene in 1990 and ISE stormed into the archaic trading pits just under a decade later, trading costs have plummeted and derivatives trading volumes have escalated dramatically.

The major advantages of using derivatives are that they are efficient in transferring huge amounts of risk; they can be customised, they are reversible and they are non-invasive. The instruments serve as a form of sophisticated 'adapters', linking nation-state financial systems together and helping to bring about a unified world economy. They have also brought about vast reductions in costs and have opened up multiple channels of financial flows.

Modern financial technology permits the separation of risk exposure selection and management from physical investment choices, capital expenditure plans, ownership and governance of assets. Risk exposures can be radically changed without affecting capital, trade or income flows or the balance sheet. Thus, risk is now a separate dimension of management decisions.

Financial innovation creates enormous opportunities to improve risk sharing, lower transactions costs and reduce information and agency costs with significant gains, especially for smaller and developing countries. However, this same innovation creates daunting challenges.

As we all know, in the past, there have been financial incidents, and even crises, that cause some to raise questions about innovations and the soundness of the financial science theories used to engineer them. With the ongoing major liquidity and credit crisis that has hit financial markets and institutions particularly in the US, UK and continental Europe, these questions are again being raised. We are still in the process of addressing the immediate impact of this crisis and in gathering the necessary data to properly analyse what happened.

Whatever those findings, global financial innovation will continue. As we look to the future, we must not ignore that cumulative innovation leads to major changes in the basic institutional hierarchy and in the infrastructure to support it. And, as a consequence of innovation, the knowledge base needed to manage and oversee financial institutions effectively can change considerably from the traditional training and experience of many managers in financial institutions and government regulators.

That knowledge gap may widen since the worldwide adoption of financial innovation is anticipated to accelerate in the impending future. Growing complexity of products and the need for more rapid decision-making will require increased reliance on computer models and with that, a need for increased managerial attention to the reliability of those models along with a more seamless interface between computer-model generated recommendations and human judgement – all of which implies a growing place for financial-engineering expertise as part of the general manager's knowledge base. The successful financial-service providers and governmental overseers in the impending future must learn to fully exploit the functional benefits of innovation in financial technology while managing the dysfunctional aspects of that innovation.

Addressing this knowledge gap offers considerable challenge to private institutions and government. The arrival of this volume, which patiently lays out the principles and definitions of derivative securities and the practical market structure to support them, could not have been better timed. Whether novice student or seasoned professional, the reader is in for a treat. Enjoy!

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