Wolfgang Hafner • Heinz Zimmermann (Eds.)
Vinzenz Bronzin's Option Pricing Models

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Exposition and Appraisal

 Springer

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Preface

The doctoral dissertation of the French mathematician Louis Bachelier, accepted by the *École Normale Supérieure* and published in 1900, is widely regarded as the seminal, rigorous work in option pricing theory[1]. However, the work remained undiscovered for more than half a century, until Paul A. Samuelson, based on an inquiry by Leonard J. Savage, discovered the piece, and an English translation of the entire thesis was published in the book of Cootner (1964).[2] Clearly, the merits of Bachelier's work are beyond option pricing; he can be credited for having developed the first mathematical theory of continuous time stochastic processes (the Brownian motion), a few years before Albert Einstein's (1905) well-known contribution.

Each scientific discipline needs – and creates – its Patron Saint. In the fields of financial economics and financial mathematics, Bachelier takes this incontrovertible position. This book does not intend to dethrone Bachelier and his seminal achievement, but aims at directing the attention to a different theoretical foundation of option pricing, undertaken by an essentially unknown author, Vinzenz[3] Bronzin, only a few years after Bachelier's work was published (1908).

This tiny booklet is entitled *Theorie der Prämiengeschäfte* (Theory of Premium Contracts), is written in German and some 80 pages long. While it received some attention in the academic literature in the time when it was published, it seems to have been forgotten later. For example it was mentioned in a standard banking textbook from Friedrich Leitner (1920), who was a professor at the *Handels-Hochschule* of Berlin. Moreover, the book got a short review in the famous *Monatshefte für Mathematik und Physik* in 1910 (Volume 21). But more recent academic mentions are

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[1] There are numerous references honouring Bachelier's work, e.g. Samuelson (1973), Bernstein (1992), Taqqu (2001), Bouleau (2004), Davis and Etheridge (2006) and others.

[2] A second, more recent translation has now been published by Davis and Etheridge (2006).

[3] Bronzin was originally born with the Italian name "Vincenzo" but is known as a mathematician with the German version of his name Vinzenz. We therefore refer in this book to the German version.

virtually inexistent[4]. Also, only a few biographical details about Bronzin are known to us: he was a professor and later, in the 1920s, the Director of the *Accademia di Commercio e Nautica* in Trieste. As a director of this academy he got also a mention in the famous *Jahrbuch der gelehrten Welt* (Yearbook of the Scientific World).

Bronzin's methodological setup is completely different from Bachelier's, at least in terms of the underlying stochastic framework where he takes a much more pragmatic approach. He develops no stochastic process for the underlying asset price and uses no stochastic calculus, but directly makes different assumptions on the share price distribution at maturity and derives a rich set of closed form solutions for the value of options. This simplified procedure is justified insofar as his work is entirely focused on European style contracts (not to be exercised before maturity), so intertemporal issues (e.g. optimal early exercise) are not of premier importance. From a probabilistic standpoint, the work is no match for Bachelier's stochastic foundations, but from a practical and applied perspective, it is full of important insights, results, and applications.

It would be interesting to know the professional or academic setting which motivated Bronzin to develop his option pricing theory. Unfortunately, not much is known about this. There is no foreword to the book, no introduction, no information about the author except a short mention as "Professor". But from a book published two years earlier (Bronzin 1906) we know that he was a professor for actuarial theory at the *K. K. Handels- und Nautische Akademie* (which after the First World War took the aforementioned Italian naming and was later divided in two separate schools, one specializing on commerce: the *Istituto Tecnico Commerciale "Gian Rinaldo Carli"*, and the other focusing on nautical studies: the *Istituto Tecnico Nautico "Tomaso di Savoia Duca di Genova"*). Trieste was at this time a true melting-pot of people from different nations – James Joyce lived in Trieste from 1905 until the beginning of the First World War – and the window of the *Donaumonarchie* to the Mediterranean Sea. As a center for oversea trading Trieste became an European center for insurance. The headquarter of *Generali* is still located in Trieste. There are not any references at the end of the book. While the publisher (*Franz Deuticke*, Vienna) is still in business, the company was not able to provide any information, and even the worldwide web does not provide any meaningful information on Bronzin either[5].

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[4] Except a recent reference from our colleague Yvan Lengwiler (2004), we are aware of only one modern reference on Bronzin's book in a German textbook on option pricing (see Welcker et al. 1988). The authors do not comment on the significance of Bronzin's contribution in the light of modern option pricing theory. A short appreciation of Bronzin's book is also contained in a recent monograph of one of the authors of this volume, Hafner (2002).

[5] By the time when we started our research (in 2004), a worldwide Google search request on "Vinzenz Bronzin" gives 5 entries: one refers to a website of the authors of Welcker et al.

A general difficulty in the attempt to write about Bronzin's book is that the text is written in German, and many of his finance related expressions (which may or may not reflect the commonly used terms at the time being) cannot be translated easily. We therefore have to find English terms as adequate as possible, and add the original German wording in parentheses where it seems to be useful[6]. Moreover we have adapted Bronzin's mathematical notation with only minor changes. In discussing, or extending certain results (particularly in Section 5, Subsection 5.6), we have tried to make a clear distinction between the results of Bronzin and our own.

Both works, Bachelier and Bronzin, shared the fate of being largely (although not completely) unrecognized during the time of publication. In view of the dramatic relevance of option pricing theory as a driver of financial and analytical innovation after 1973, the publication year of the Black-Scholes-Merton models and the launch of the first exchange traded standardized financial options (at the Chicago Board Options Exchange, CBOE), this is an incomprehensible observation indeed. However, this is not an isolated instance in the history of science. There were always ignored, overlooked, undervalued, or simply forgotten scientific works – which should become fundamental from a later perspective. This is the natural consequence of the evolutionary nature of the scientific process. Even the field of finance offers, apart from the case of option pricing, several examples: The mean-variance approach of portfolio theory was developed by Bruno de Finetti in the 30s (see de Finetti 1940), more than a decade before the seminal contribution by Harry Markowitz, before getting adequately recognized[7]; furthermore, an alternative and very accessible approach to portfolio selection was published by Andrew Roy in the same year as Markowitz's work without getting any academic credit until the 90s[8]. The random walk model and major insight about efficient markets (without naming it so) were advanced by the French Jules Regnault in the 60s of the 19th century (see Regnault 1863), without being noticed by Bachelier, Samuelson, Fama and other advocates of the market efficient literature altogether[9]. A final example is the development of expected utility theory where the earliest – and according to Y. Lengwiler (see Chapter 20 in this volume) most powerful – statements date back to Gabriel Cramer and Daniel Bernoulli in the 18th century.

(1988), where the book is quoted in the footnotes, the other four are related to documents released in our own academic environment. Also, searches in electronic archives such as JSTOR did not provide results.

[6] Occasionally, interested readers find important sentences in the full original German wording in footnotes.

[7] See Chapter 19 by F. Pressacco in this volume.

[8] See Roy (1992) for his own contribution after 40 years after his original publication.

[9] See Jovanovic (2006) for an appreciation.

About this Book

This volume includes a facsimile reproduction of Bronzin's original treatise as well an English translation of it. We are grateful to the publisher Franz Deuticke, Vienna, and the still living heirs of Bronzin, Giorgio Raldi and Gherardo Bronzin, for the permission to reproduce the work. Ralf Lemster Financial Translations in Frankfurt on the Main, in particular Igor Uszczapowski, provided an excellent translation of the book; in particular, they succeeded in adapting the old-fashioned German wording to a contemporary writing style and yet conserving the character of the original text.

In addition, the volume offers contributions to the scientific, historical and socio-economic background of Bronzin's work, as well as papers covering the history of derivative markets and option pricing. All these chapters represent original contributions, and we are extremely grateful to the authors for their effort to discuss and redraft their text over several stages.

This work would not have been possible with the support of many people and institutions. First and foremost, we are grateful to the Bronzin families in Trieste, who helped and supported us in our research in any respect, and made us available private documents. We are particularly grateful to Stellia and Giorgio Raldi, to Vinzenz Bronzin's son Andrea Bronzin (who passed away in 2006) and Gherardo Bronzin. The first contact to the Bronzin family was kindly established by Anne Perisic.

In Trieste, the following persons were extremely helpful with respect to contacts, information, and suggestions: Anna Millo, Anna Maria Vinci, Ermanno Pitacco, Arcadio Ogrin, Patrik Karlsen; Sergio Cergol and Clara Gasparini from *RAS*, and from *Generali*: Barbara Visintin, Alfred Leu, Alfeo Zanette, Marco Sarta, Ornella Bonetta (*Biblioteca*). The staff of the *Archivio di Stato di Trieste*, of the *Biblioteca Civica di Trieste*, and the *Biblioteca dell'Assicurazioni Generali*, Trieste, was extremely helpful and supporting. In addition we are grateful to Marina Cattaruzza for helpful advice.

Partial financial funding by the *WWZ-Förderverein* at the *University of Basel* is gratefully acknowledged under the projects No. B-086 and B-107. Without this seed money, the project could not have been started. The *Eurex*, represented by Andreas Preuss, provided the essential funding of the second stage of the project, in particular the translation of Bronzin's treatise.

We are extremely grateful to the *Springer Verlag* for its interest and support for including this book into its publishing program. Special thanks go to Dr. Birgit Leick, the responsible editor, who supported this venture with continuous encouragement, suggestions and helpful comments which significantly improved the final product. Tatjana Strasser and Kurt Mattes did a highly professional job in the production of the final manuscript. Hermione Miller-Moser, Roberta Verona and her staff from *Key Congressi* in Trieste, and again Igor Uszczapowski provided linguis-

tic advice and excellent translations of individual chapters. The assistance of Yves Straub was extremely helpful along the entire editorial process, from the earliest versions until the proofreading of the individual chapters.

Prior to this publication, we had the opportunity to make our research accessible to an international audience by a chapter contributed to Geoffrey Poitras book about *Financial Pioneers* (2006), and a paper in the *Journal of Banking and Finance* (2007).[10] We are grateful to its editor, Giorgio Szegö, for his support and interest. Part of the material included in our Chapters 5, 6, 7 and 9 in this volume is based on these publications.

In 2007, the *Comitato in Onore del Prof. Bronzin* was founded in Trieste under the auspices of Prof. avv. Vittorio Cogno with the secretary Stellia Raldi and the scientific adviser Ermanno Pitacco, representatives of the Bronzin family, of the *Istituto Tecnico Nautico "Tomaso di Savoia Duca di Genova" and of the Istituto Tecnico Commerciale "Gian Rinaldo Carli"* in Trieste. This work of the committee accelerated the public perception of Bronzin's work, and a *Giornata di Studi* was organized on December 13, 2008, in Trieste with the moderation of Lorella Francarli. We are grateful to the organizers and sponsors of this conference for their effort and support. Barbara Visintin provided excellent translations of the non-Italian talks.

We conclude this foreword by quoting Espen Haug from Chapter 17:

"The history of option pricing and hedging is far too complex and profound to be fully described within a few pages or even a book or two, but, hopefully, this contribution will encourage readers to search out more old books and papers and question the premisses of modern text books that are often not revised with regard to the history option pricing".

We hope that our readers share this insight, and that this book contributes another piece to a fascinating puzzle.

Windisch and Basel, Switzerland, January 2009

Wolfgang Hafner
Heinz Zimmermann

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[10] The respective references are Zimmermann and Hafner (2006, 2007).

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1   Vinzenz Bronzin – Personal Life and Work

Wolfgang Hafner and Heinz Zimmermann

Vinzenz (later: Vincenzo) Bronzin was born in Rovigno (today: Rovinj), a small town on the peninsula of Istria (Croatia), on 4th May 1872, and died in Trieste on the 20th December 1970 at age 98. He was the son of a commandant of a sailing-ship. After completing the gymnasium (high school) in Capodistria, a town on Istria, he became a student in engineering at the University of Polytechnics in Vienna, where he made his exams after an enrolment of two years. He then studied mathematics and paedagogics at the University of Vienna, and at the same time, he took courses for military officers in Graz.

In his obituary, his nephew Angelo Bronzin reports that he was a well known gambler and a champion in fencing during his time in Vienna. In 1897 he became a teacher in mathematics at the Upper High School of Trieste (*Civica Scuola Reale*

Vinzenz Bronzin at the gymnasium in Capodistria in 1891. Bronzin is the first in the upper row from left
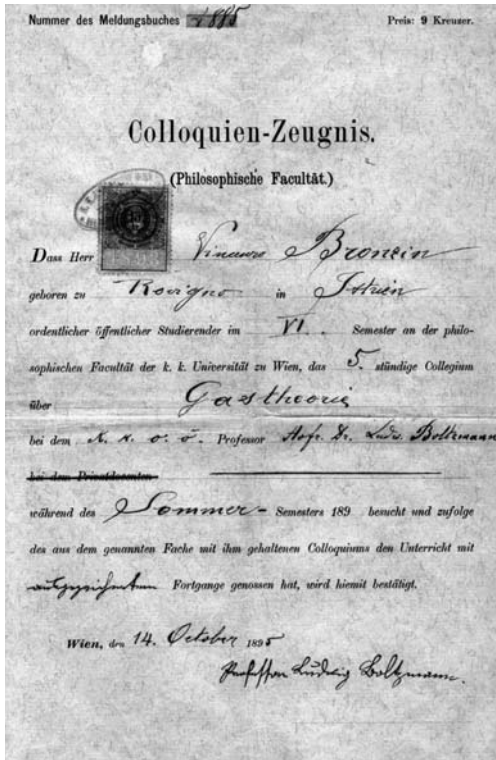
In 1895 Bronzin attended lectures on the *Gastheorie* by the famous physicist Ludwig Boltzmann at the University of Vienna

Superiore di Trieste). In 1900 he was nominated professor for commercial and political arithmetic at the *I.R. Accademia di Commercio e Nautica*. He was the director of this institution from 1910 to 1937. Apparently, his reputation was overwhelming. In a book published in 1925, he was euphorically called "a jewel of humanity" (*eine Zierde der Menschheit*) and "heroic scientist".[11]

Why was V. Bronzin interested in probability theory? Why was he interested in derivative (option) contracts? We have only partial answers to these questions, sometimes only hypotheses, even though we had the opportunity to talk with his son in March 2005, Andrea Bronzin (1912–2006).

Many questions remain open because Andrea was born after the time period most relevant for our research (1900–1910), and because, apparently, finance and speculation was no topic his father used to talk about or deal with in later years. In accordance with his son Andrea Bronzin we suggest that Vinzenz Bronzin wrote his (1908) book for educational purposes.[12] This seems to be true for all his earlier

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[11] De Tuoni (1925).

[12] From a letter dated 17/01/2005: "*Mio padre ha scritto la teoria delle operazioni a premio perché attinenti al suo insegnamento presso l'Accademia di Commercio di Trieste ed alter Accademie di Commercio austriache.*"

Bronzin and his son Andrea in 1916

publications (e.g. 1904, 1906, 1908), which grew out of subjects of his lectures at the *Accademia di Commercio e Nautico* in Trieste, where he was a professor for "Political and Commercial Arithmetic". Both fields were part of the mathematical curriculum and also included actuarial science and probability theory – however, on a rather applied level. The term "Political Arithmetic" was used to characterize the application of basic mathematics and statistics to a wide range of problems arising in areas such as civil government, political economy, commerce, social science, finance, and insurance. In particular, the field included topics like compounding, annuities, population statistics, life expectancy analysis et al., which had certainly a focus on the needs of the insurance companies[13]. "Commercial Arithmetic" was more accomplished to the needs of the banking industry and international orien-

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[13] The program at the Accademia included: "*Elementi di calcolo di probabilità (probabilità assoluta, relativa, composta. Probabilità rispetto alla vita dell'uomo. Durata probabile della vita. Aspettativa matematica e posta e posta legittima nei giuochi di sorte).*" Source: (1917), pp. 163–164.

The building of the *I.R. Accademia di Commercio e Nautica* of Trieste at the beginning of the 20th century

tated trading companies.[14] At this time, it was a well established tradition among professors to publish books about the topics they covered in their lectures[15].

The first publication of Bronzin which is documented in his own curriculum is a short article entitled "*Arbitrage*" in a German journal for commercial education (Bronzin 1904)[16]. The paper is about characterizing relative price ratios of goods across different currencies and associated trading (arbitrage) strategies. While interesting per se, it is unfortunately not directly related to the "arbitrage valuation principle" of derivatives valuation – which Bronzin, ironically, uses as a key valua-

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[14] For example: "*Arbitraggio di divise, effetti, valuti e di riporto. Borse. Affari commerciali secondo le norme di Borsa in merci ed effetti. Arrangement ... Spiegazione delle quotazioni di divisen e valute sulle piazze commerciali d'oltremare più importanti per l'importazione ed esportazione europea.*" Source: Subak (1917), p. 164.

[15] See Subak (1917), pp. 257ff, and Piccoli (1882).

[16] We found only one reference to this paper, in Subak (1917), p. 274. The aim of the journal was to publish critical and original surveys on subjects relevant for educational purposes, contributed by the leading scholars in the field ("*Die 'Monatsschrift für Handels- und Sozialwissenschaft' berichtet über alle das Gebiet ... (des) Unterrichtswesen betreffenden Fragen in kritisch zusammengefassten Originalartikeln von ersten Fachleuten*"); Source: *Monatsschrift für Handels- und Sozialwissenschaft 12* (15 December 1904), pp. 356–360.

tion principle (based on his "principle of equivalance") in his option pricing book, however whithout using this term[17].

Bronzins second publication (Bronzin 1906) is a monograph on Political Arithmetic (*Lehrbuch der politischen Arithmetik*); it was approved by the ministry of education as an official textbook to be used at the commercial schools and academies in the Empire[18]. Bronzin had not – in contrast to many of his colleagues at the Accademia – published extensively. It is therefore more than surprising, if not strange, that he did not quote his (1908) option pricing piece in a publication (a festschrift) released for the centenary of the school[19]. Had it become such a "queer" subject in the meantime? As shown in Chapter II.3, it was indeed unusual to apply probability theory to speculation and financial securities pricing in these times, but why should he suppress his major scientific contribution he had produced so far? Was the subject too complicated for the target audience, or did he get frustrating responses?

It is true that gambling, speculation, or trading with derivatives did not enjoy a major popularity around this time[20]. In the last decade of the 19th century, derivatives were more and more blamed to cause exuberant market movements and to be socially harmful. Furthermore, in 1901, a court of justice accepted the "gambling" argument (*Spiel und Wette*) in a legal case in Vienna. Thereafter, forward trading declined and got more and more unimportant.[21] At the rather small stock-exchange of Trieste, premium contracts have not been traded at all during these years.[22] But was this practical limitation a sufficient reason for Bronzin to suppress this publication? Was his interest in derivatives (and finance in general) so much determined by practical matters[23], or was it more on the theoretical side? Unfortunately, we do not have definitive answers.

Writing books must have been hard work for Bronzin anyway. Beside his academic position, Bronzin was nominated director of the *Accademia* in 1909, but he

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[17] The closest statement to what we now call "aribtrage strategy" (providing a riskless profit without positive net investment) can be found in his *Theorie der Prämiengeschäfte*, in the last sentence on p. 38.

[18] This is reflected in the subtitle of the book: "… *zum Gebrauche an Höheren Handelsschulen (Handelsakademien) sowie zum Selbstunterricht*".

[19] See Subak (1917)

[20] See Stillich (1909), pp. 1–18, pp. 181–227, for a representative discussion of these issues at that time.

[21] Schmitt (2003), p. 145.

[22] Archivio dello stato di Trieste, atto "*Listino Ufficiale della Borsa di Trieste*" from 1900 to 1910.

[23] At least, all but one of his option valuation models just require pencil and paper to compute option prices; only one model requires a probability distribution table (the law of error, i.e. the Normal distribution) which the author reproduces in the Appendix of his book.

Bronzin at the celebration of his retirement as president, circumvented by alumnies of the commercial school *I.T.C. "Gian Rinaldo Carli"*. The alumnies gifted him a sailing-boat at this occasion

was not yet able to accept the nomination, because he was suffering from a strong nervousness, apparently caused by his efforts of writing the two books ("*in forte nervosità*" because of "*compilazione e publicazione di libri matematici*").[24] One year later he was offered the same position again, and he then accepted. Shortly afterwards, there were plans to launch a Commercial College (*Handelshochschule*) in Vienna, and Bronzin had good chances getting an appointment as a professor[25]; however, with the outbreak of the First World War, the project had to be abandoned. Bronzin resigned from his positions at the *Accademia* in 1937, at the age of 65.

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[24] Archivio dello stato di Trieste, atto *Accademia di Commercio e Nautica in Trieste*, b 101 e regg 273, 1909, AA 345/09, from the 31.07.1909. In August 1909, also one of his beloved daughters died.

[25] Based on private communication with Andrea Bronzin.

Piazza della Borsa di Trieste (Square of the Stock Exchange) in the fourth quarter of the 19th century

His major achievement as a director of the *Accademia* was seen in his ability to guide the school through a time of big political turbulences before, during and after the first world war. He still preserved a great reputation as mathematician. As we mentioned above, at least during his study years in Vienna, he had the reputation of being a successful gambler.[26] Combining mathematics with gambling seem to have been a perfect fit to write his option pricing theory. Interestingly, no consulting activities are known or documented. He was several times asked to join insurance companies but preferred to stay in academia.[27]

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[26] Obituary of his nephew, Angelo Bronzin.

[27] Letter as of December 30, 2004, from Arcadio Ogrin, summarizing a conversation with Andrea Bronzin.

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page 10: Courtesy of Arcadio Ogrin, from the collection of the Istituto Nautico, Trieste
page 13: Courtesy of Libreria Italo Svevo di Franco Zorzon, Trieste

Stefan Zweig: A Representative Voice of the Time

When I attempt to find a simple formula for the period in which I grew up, prior to the First Word War, I hope that I convey its fullness by calling it the Golden Age of Security. Everything in our almost thousand-year-old Austrian monarchy seemed based on permanency, and the State itself was the chief guarantor of this stability. The rights which is granted to its citizens were duly confirmed by parliament, the freely elected representative of the people, and every duty was exactly prescribed. Our currency, the Austrian crown, circulated in bright gold pieces, an assurance of its immutability. Everyone knew how much he possessed or what he was entitled to do, what was permitted and what forbidden. Everything had its norm, its definite measure and weight. He who had a fortune could accurately compute his annual interest. An official or an officer, for example, could confidently look up in the calendar the year when he would be advanced in grade, or when he would be pensioned. Each family had its fixed budget, and know how much could be spent for the rent and food, for vacations and entertainment; and what is more, invariably a small sum was carefully laid aside for sickness and doctor's bills, for the unexpected. Whoever owned a house looked upon it as a secure domicile for his children and grandchildren; estates and businesses were handed down from generation to generation. When the babe was still in its cradle, its first mite was put in its little bank, or deposited in the savings bank, as a "reserve" for the future. In this vast empire everything stood firmly and immovably in its appointed place, and at its head was the aged emperor; and were he to die, one knew (or believed) another would come to take his place, and nothing would change in the well-regulated order. No one thought of wars, of revolutions, or revolts. All that was radical, all violence, seemed impossible in an age of reason.

This feeling of security was the most eagerly sought-after possession of millions, the common ideal of life. Only the possession of this security made life seem worth while, and constantly widening circles desired their share of this costly treasure. At first it was only the prosperous who enjoyed this advantage, but gradually the great masses forced their way toward it. The century of security became the golden age of insurance. One's house was insured against fire and theft, one's field against hail and storm, one's person against accident and sickness. Annuities were purchased for one's old age, and a policy was laid in a girl's cradle for her future dowry. Finally even the workers organized, and won standard wages and workmen's compensation. Servants saved up for old-age insurance and paid in advance into a burial fund for their own interment. Only the man who could look into the future without worry could thoroughly enjoy the present.

from: *The World of Yesterday*, Viking Press, 1943
Chapter 1: The World of Security
Translated edition, The University of Nebraska Press, 1964

2 How I Discovered Bronzin's Book

Wolfgang Hafner*

It was in the 1990's when my joint project with Gian Trepp on "Money Laundering through Derivatives", which had been financed by the Swiss National Science Foundation, was under way. The research for this project was eye-opening. It helped me to understand how derivative instruments work and how they were steadily gaining more importance. I then met people in charge of dealing with these instruments, however working more on the scarcely lit side of this maverick world of modern finance. Among them there were some interesting people from the World Bank and from the International Monetary Fund. I also got the chance of talking to the Senior Advisor to the Under Secretary Enforcement of the US-Treasury, Michael D. Langan with his staff in summer 1998.

The meeting with the US-treasury people was revealing. It gave rise to my impression that the administration was a little bit helpless when confronted with the possibilities for using derivatives for money-laundering. I outlined the system to them, giving them examples. A terrorist organization, or an individual criminal may own two accounts and use them to simultaneously buy and sell financial derivatives. On the first account, which contains the dirty money, a forward transaction may be initiated which would be in complete opposition to market expectations and to all odds. The second account would serve as the counterpart for the deal. Upon exercise, the first account would lose while the second one would in turn make money. Thus, as a result the losses in the dirty money account will have been transformed into legitimate profits in the clean money account. Through this process the dirty money could be laundered. Meanwhile, the inevitable transaction costs, chalked up as business expenses, keep the banks and brokers happy.

In London I also met the responsible compliance manager at Credit Suisse Financial Products (CSFP), Tony Blunden, who at that time confirms their full control of the issue. Some months later he was kicked out of his job as a scapegoat. CSFP has been fined by the Japanese Banking Authorities (FSA) for their maverick instruments they had sold to Japanese companies. These derivative contracts helped "to fly away" financial losses either to special purpose entities located offshore or, otherwise, by making use of a type of contracts that were based on the

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ancient Japanese accounting system for companies. Each company had its own key date for reporting, and with fraudulent contracts based on derivatives it was possible to repeatedly roll over the loss from the balance sheet of one company to another. A perfect hideaway for the loss.

In this process I gained a more critical approach towards these instruments. Yet on the other hand I was also amazed and surprised by the possibilities that were offered to the financial community through derivative constructions. This made me curious to learn more about these double-edged instruments. As an economic historian I started to dig into the past. I read Edward J. Swan's book "Building the Global Market" (Kluwer 2000), and then Peter Bernstein's bestseller "Against the Gods" (Wiley 1998) about the history of risk-management. I was astonished about the great importance that Bernstein attributed to the contribution of the – namely – American mathematicians to the development of models for the calculation of option-prices and to portfolio-theory. As a historian I was also familiar with the strong trading of derivatives in Europe at the end of the 19th and the start of the 20th century. I was skeptical to believe that it should have been only Louis Bachelier to have successfully worked on a model for computing option prices.

In the meantime I was convinced that it would prove worthwhile to publish a popular version of my research about money-laundering through derivatives along with its glimpse on the history of derivatives. The German publisher Eichborn was interested in this venture, and the book *Im Schatten der Derivate* ("In the Shadows of Derivatives") appeared in 2002.

I continued my historical research and became aware of the great importance of derivative contracts in Europe at the end of the 19th century. In an article published by R. Gömmel on *Entstehung und Entwicklung der Effektenbörsen im 19. Jahrhundert bis 1914* ("Emergence and development of security exchanges in the 19th century until 1914")[28] we read that 60 percent of the trading activity at the German stock-exchanges were transactions for future delivery (forward contracts mostly). I intensified my research focusing on this issue and also asked my antiquarian bookseller to search for the major historical books about banking and speculation published in these days. I hoped through his help to find some contemporary textbooks for students in finance that would specifically follow a practical approach. I was also amazed about the huge production of books about derivatives (*Termingeschäfte*) that have been published at this time.

One of the books I found was written by Friedrich Leitner, a professor at the Handels-Hochschule Berlin, entitled *Das Bankgeschäft und seine Technik*, 4th edition, published in 1920. On some 60 pages, Leitner wrote about the different types of derivative contracts as *Prämiengeschäfte*, *Stellage*, *Nochgeschäfte* and so on. He also used different diagrams, for example, to illustrate put-options

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[28] published in: Deutsche Börsengeschichte, edited by Hans Pohl, Fritz Knapp Verlag, 1992, pp. 133–207.

and other trading-tactics. In a footnote he mentioned Bronzins book, *Theorie der Prämiengeschäfte*, and noted that it "deals with the subject from a mathematical point of view".

I got hold of Bronzin's book through my library and was truly amazed. Bronzin showed formulas that were apparently similar to the famous formula of Black-Scholes with which I was then already familiar. I needed to be both certain and scientifically backed in case the issue would turn out to be a rediscovery of an up to then forgotten book. This made me write an email to Professor Heinz Zimmermann from the Department of Finance at University of Basle who I knew from a panel discussion and estimated as an outspoken academic, asking him whether he had ever heard of this obscure professor. Zimmermann had not and was at first extremely doubtful. He knew, of course, Bachelier's early contribution to the theory of finance which had been laying dormant for so long. Now, all of a sudden another forgotten pioneer should appear out of nowhere? The question came: How often can the wheel be *pre*-invented? Zimmermann was close to dismiss the information I had sent him. Yet the more he read, the more surprised he became. Soon his initial skepticism gave way to keen interest and fascination. In fact, after the re-discovery of Regnault, Lefèvre and Bachelier, no less than a new pioneer was on stage.

Part A

Theorie der Prämiengeschäfte

Vinzenz Bronzin

THEORIE

DER

PRÄMIENGESCHÄFTE.

VON

VINZENZ BRONZIN,

PROFESSOR.

Inhaltsverzeichnis.

II. Kapitel.

Anwendung der allgemeinen Gleichungen auf bestimmte Annahmen über die Funktion $f(x)$.

Tafel I.