Nieuwe financiële instrumenten

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SUMMARY

Research in the field of security design is the central topic of this dissertation. The book consists of two parts. Part I is mainly theoretical. In it we summarize the parts of the modern financial economic theory that are relevant to our study. This forms the basis for part II, which contains financial economic analyses of four 'new financial instruments' that appeared on the Dutch capital market during the late eighties and the early nineties. An important objective of part II is to provide insight into the empirical applicability of modern financial economic theory.

We define security design as the process of designing and marketing financial instruments that are different from the ones already at hand. This definition leaves room for interpretation. What exactly is meant by designing? When does a financial instrument differ from others? We thoroughly investigate these and other related questions. The reflection of that investigation can be found in chapters 1, 2 and 3.

We also examine the subject of financial innovation. In chapter 1 we present criteria that are of help in answering the question whether an outcome of security design can be called a financial innovation, or has the potential to become one.

Part I: Theory

The modern financial economic theory has a micro economic orientation. In this orientation, subjects and agents buy and sell objects (financial instruments for investment and risk-management) in financial markets. We introduce an idealized financial system in which the financial markets are perfect and in which the subjects and agents behave rationally. A thorough investigation leads to the conclusion that perfect markets with rational agents and subjects are automatically efficient and complete. Transaction costs, taxes, impeding regulations, etcetera do not occur. Moreover, there is free competition, and the actions of individual participants have no impact on, for instance, prices of financial instruments. These prices contain all relevant information. This 'ideal world' is the starting point for most of the mainstream models within the theory of finance and investment.

In chapter 2 we conclude that security design does not make sense in the idealized financial system, and that in such a system financial innovation is not possible. This ideal world however, is way beyond reality. That is one of the main reasons why, in reality, we observe several manifestations of security design, some of which are financial innovations.

Various models involving different market imperfections have been built. In the first part of chapter 3 we review some of the - theoretically oriented - literature related to this

matter. In the second part of this chapter we discuss various published - empirically oriented - papers regarding actually issued new financial instruments. All the authors of the case-studies use various financial economic models based on the forementioned micro economic orientation. Mainly because of the impacts of imperfections and limited rationality, they provide carefully balanced appraisals of the results.

An important part of this dissertation is devoted to research into the characterization and valuation of various 'new' financial instruments that can be regarded as derivative securities. In this framework, the determination of replication values is a central issue. Assume that a financial instrument I can be replicated by other existing financial instruments. With the replicating portfolio we can characterize I. Moreover, with the prices (or theoretical values) of the components of the replicating portfolio, it is possible to determine the replication value of I. Assuming that risk free arbitrage opportunities do not exist, the value of the replicating portfolio must be equal to the value of I. A replication value that deviates from the market price, can be explained by the existence of various imperfections and/or limited rationality. A financial instrument that provides the opportunity to reduce constraints from imperfections and/or limited rationality can become a financial innovation.

Part II: Cases

The financial instruments discussed in part II (chapters 4 through 7) are more or less unique. This is reflected in the nature of the individual chapters. However, there are various similarities, mainly because of the modern financial economic orientation used in the four case studies. This summary starts with these similarities.

Each chapter starts with a description of the financial instrument under study. The description leads to a financial analysis, and results in a valuation model. In principle, the models are based on the concept of replication.

We explicitly distinguish a buy-and-hold replication from a dynamic replication strategy. A buy-and-hold replication is characterized by the fact that the replicating portfolio can be left unaltered during the relevant time to maturity. A replication strategy is called dynamic if the replicating portfolio has to be changed during the relevant time to maturity. This distinction is important, because it affects the conclusions which can be drawn from deviations between replication values and market prices.

Conclusions based on a buy-and-hold replication can be drawn more strictly than conclusions based on a dynamic replication strategy. For this there are two main reasons. Firstly, a buy-and-hold replication leads to less transaction costs. Secondly, and more fundamentally, the success of a buy-and-hold replication depends neither on the values of

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the various replicating components, nor on the levels of the other value-determining parameters during the time to maturity. This is in contrast with models where a dynamic strategy is needed. These models require, for instance, an explicit specification of the price process of the replicating components.

Each of the chapters 4 through 7 include an appendix. These appendices contain the comparative statics analysis of the general form of each instrument. Based on the replication value, we derive the so called hedge parameters. They provide an insight into the sensitivity of the value of the specified instrument to a small change in the level of the value-determining parameters. The appendices also include graphical illustrations.

In general, hedge parameters are important for investors as well as for investment banks. Knowledge of the level of these parameters can help investors to appraise the risk characteristics of financial instruments. Investment banks can use the knowledge for hedging purposes. We want to emphasize that one has to be careful to draw strict conclusions from the quantitative results in the appendices. The main reason being the possible disturbing impact of transaction costs and other market imperfections.

In chapter 4 we provide an analysis of two special financial contracts of which the values depended on the level of one of the market indices of the Amsterdam Stock Exchange: a bullish long spread (*BULS*) and a bearish long spread (*BELS*). They were issued together with a 'normal' bond. However, after issuance, the bond, the *BULS* and the *BELS* could be traded separately on the Amsterdam Stock Exchange. Our analysis demonstrates that the issuing of the package provided a partially 'free lunch' for the issuer. This free lunch was mainly due to the low issue price of the combination of the *BULS* and the *BELS*. A *BULS* can be seen as a combination of a long and a short call option. The *BELS* consisted of a long and a short put option. A combination of one *BULS* and one *BELS* was in fact a zero-coupon bond, and as such could be replicated with a buy-and-hold strategy.

In principle, the individual contracts could also be replicated with a buy-and-hold strategy. It would require the implicit index options. However, at the time of issuance, exchange-traded index options did not exist. Therefore, they should be arranged over-the-counter, or replicated following a dynamic strategy involving 'Black-Scholes principles'. We already noticed that such a strategy leads to a lot of transaction and other 'costs'. Various calculations based on Black-Scholes principles do not show consistent deviations between the market prices and theoretical values of the individual contracts, during the time to maturity (1986-1991). All in all, we cannot derive strict conclusions from the pricing of the individual contracts.

A combination portfolio of one *BULS* and one *BELS* was very attractive to investors who were subject to a relatively high marginal income tax rate. This was mainly due to the fact that in the Netherlands an investor had (and at this moment still has) to pay income

tax on the implicit interest of a normal zero-coupon bond; the implicit interest on the synthetically created zero-coupon bond was tax-free. During the time to maturity of the two contracts, the mean replication value of the combination portfolio, which was corrected for this fiscal aspect, was significantly higher than the mean market price.

We also provide some possible explanations for the introduction of the index-contracts. With these instruments, new risk profiles could be obtained more easily. Moreover, investors got the possibility to explicitly follow a bearish view (buying the *BELS* and selling the *BULS*) or, *vice versa*, follow a bullish view.

We do not label the contracts financial innovations. Firstly, because the introduction of individual index options was already imminent. And secondly, because no similar contracts were issued afterwards in the Netherlands.

Chapter 5 contains an analysis of the Ladder Call Warrant (LCW). The LCW was a special kind of call option on the market index of the European Options Exchange. The issuer specified four barriers. The paper gain on the LCW was fixed each time when the level of the index reached a barrier. Consequently, the investment was downside protected, and each moment a barrier was reached the floor was put at a higher level. An investment in the LCW provided a partial avoidance of possible regret for the investor.

We demonstrate that, in principle, the LCW was equivalent to an investment portfolio containing one long call option, four short up-and-in put options and four long up-and-in put options. The LCW could be replicated with a buy-and-hold strategy that consists of acquiring this portfolio of nine options. However, there were (and still are) no exchange-traded up-and-in put options, and we strongly doubt wether they could be bought over-the-counter at a reasonable price.

The LCW could also be replicated by a dynamic strategy of the Black-Scholes type. We construct the model for the replication value of the LCW. The replication values are compared with the market prices at only a few points in time because the liquidity in the contract was very low. Therefore, we are not able to draw statistical significant conclusions regarding over- or undervaluation. Moreover, as mentioned before, the needed dynamic replication strategy would have led to a considerable amount of transaction and other costs.

We present an alternative replication strategy with listed, regular call options on the market index. This alternative strategy requires a rebalancing of the replicating portfolio to a maximum of four times. We simulate this alternative strategy *ex post* while abstracting from transaction costs and fiscal aspects. The strategy appears to be more expensive than buying the LCW itself. Based on this and other facts, products like the LCW look attractive to a special group of investors.

There has not been much trading in the LCW. However, in the Netherlands there is a growing trend in issuing comparable products. They appear in the form of life insurance products, as well as investment products. Although with some reservation, according to the

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criteria we formulated in chapter 1, we call the LCW a financial innovation.

The Centurion Warrant (CW), discussed in chapter 6, has only been traded over-the-counter. Therefore, we do not have price information. The CW was a kind of a call option on a share of the Philips Electronics corporation, with a stochastic exercise price that was linked in a special way to a share of PolyGram. At the time of the issue, Philips owned about 80% of the shares of PolyGram. The CW was structured in such a way that an investor could in fact create an investment in Philips without the implicit investment in PolyGram. The time to maturity of the CW was equal to the time to maturity of Centurion, the code name for a special restructuring operation of Philips. The purpose of the operation was to make the company profitable again. If Centurion would be successfully completed, it would lead to profits on an investment in the CW. Our analysis shows that a buyer of the CW indeed did profit from the success of Centurion, but not as much as the issuer promised. This is due to the fact that, in theory, the debtholders of Philips shared in the profit from the Centurion success.

We also discuss the valuation model for the CW, which is a version of an option to exchange one asset for another: an exchange option. The Black-Scholes model is a special case of this valuation model. Some points have to be noticed. Firstly, the correlation coefficient between the price movements of both underlying values appears to be an important parameter with respect to both valuation and hedging. A relatively high correlation leads to a relatively low value of the exchange option. Secondly, the magnitude of the volatilities of both underlying values and their correlation is of critical importance to the value of the exchange option. It is remarkable that a higher volatility of one of these underlying values can lead to a lower value of the exchange option. This may occur when the volatilities sharply differ in magnitude and the correlation coefficient is relatively high. Thirdly, the rate of interest is of no importance to the theoretical valuation of an exchange option (under the restriction that both underlying values are traded instruments for investment purposes only).

Until now, publicly traded exchange options do not exist in the Netherlands. However, there seems to be possibilities for the issuance of exchange options on all kinds of underlying values. The CW was a very interesting result of security design, but again, according to our criteria it cannot be called a financial innovation.

This last remark also holds for the Leveraged Income Obligation via New Shares (LIONS), discussed in chapter 7. The LIONS is a long term bond with a special feature: instead of paying interest, the issuing company delivers its own shares. To some extent, it resembles a zero-coupon convertible bond with a forced conversion feature.

In principle, there are two methods to replicate a LIONS. The most suitable alternative is buying a zero-coupon bond (with the same par value as the LIONS itself), in combina-

tion with the number of shares an investor gets anyhow if he buys the LIONS itself. This replication portfolio must be financed partially with the present value of the dividends the investor does not receive if he buys the LIONS itself.

Trading in the LIONS was relatively lively, especially in the early years of the time to maturity. We demonstrate that the replication value was strongly dependent on the fiscal position of the investor. The LIONS appears to be very attractive for investors with low marginal income tax rates. From their point of view the issue price appeared to be low, compared to the theoretical value. Moreover, the mean realized prices during the time to maturity appeared to be significantly lower than the mean theoretical values, again looking from the point of view of an investor with a low marginal income tax rate. These conclusions are very robust: realistic changes in the levels of the most important value-determining parameters do not alter them.

Chapter 8 contains a summary of the study and some evaluating remarks. One of the conclusions we reach is, that this study can be used by a financial institution that wishes to issue new financial instruments. It provides a framework for security design, and it demonstrates some of the conceptual and measurement problems, together with several other aspects, which a financial institution has to take into account. Moreover, an investor can use the study as a reference guide for the analysis of new financial instruments which he possibly wants to invest in.

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Alderson, M., K. Brov
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Alderson, M.J. en D.R
Auction Rate Prefe

Allen, F. en D. Gale [1
pp. 229-263.

Allen, F. en D. Gale [
Massachusetts.

Arrow, K.J. [1964], 'T
Economic Studies,

Assurantiekantoor Stad
1997, Rotterdam.

Bank for International

Barber, B.M. [1993], '

Barnea A., R.A. Haug
Prentice-Hall, Engl

Beckers, S. [1981], 'S
Price Variability', .

Berkman, H. [1992],
European Options

Black, F. en M. Schol
Political Economy,

Blattberg, R. en N. G
Statistical Models f

Bodie, Z. [1988], 'Infl
National Bureau of

Bodie, Z. [1989], 'Infl
Research, Cambrid

Boot, A.W.A. en A.V
pp. 1349-1378.