Hedging:

A Bird's Eye Perspective

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April 2004

Abstract

In this paper, we discuss various aspects of hedging in the wider context of the risk management process. It is meant as a non-technical introduction for non-specialists.

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Introduction

The globalization of business paired with rapid technological changes and increased volatility in the financial markets has changed the risk profiles of many companies dramatically. Firms have responded by embracing the concept of financial risk management. Mitigating or neutralizing excess risk exposures through hedging is widespread corporate practice nowadays. For novices in this field, we provide a concise and non-technical overview of hedging and its various aspects. In addition, we hope to wet your appetite for the broad field of risk management. In the limited scope of this article, we do not strive for completeness or for explicit scientific rigor in the form of detailed references. We therefore confine ourselves to general references at the end of this article.

Dial H for Hedging

Hedging can be defined as taking actions to mitigate or eliminate risk exposures. The antipode is speculation or "Texas hedging" which amplifies existing exposures or generates new risks. In every day's language one can say "you run great risk", but for a better understanding we should distinguish between risk sources and risk exposures.

Risk sources (or factors) generate the risk and by distinguishing between different risk sources a rich typology of risks can be drawn. Market, credit and operational risks are the major risk categories. Market risk relates to interest rates, exchange rates, equity prices and commodity prices. Credit risk refers to the ability (or willingness) of a counterparty to fulfill its obligations. Since the Russian debt crisis in 1998, the impact and importance of this risk category has become painstakingly clear. Operational risk is a broad category, encompassing all risks stemming from the firm's operational activities. This includes the risks attached to the technology of the production process (including accidents), risks stemming from inadequate organization structure, from inadequate external disclosure (including accounting fraud), from human error and other fraud (see later), and from reputational damage.

Risk exposures reflect the degree to which the firm is vulnerable to a risk source. The size of an exposure determines the degree in which fluctuations of a risk factor propagate to the firm's cash flows or market value (the present value of future cash flows). The goal of hedging now is to mitigate undesired fluctuations in cash flows or in market value.

Tales of the unexpected

Risk has two aspects: it is unexpected (by definition), and the materialization of risk has adverse effects. The former aspect relates to "uncertainty" in the sense of deviating from the expected, whereas the latter implies a focus on the "downside". Although the outcome of a lottery is not known beforehand, buying a lottery ticket doesn't expose you to risk (only to "upside potential"). Risk is sometimes defined as "measurable uncertainty", which implies that the future can adequately be described in terms of probability distributions (which in turn may be conveniently described by some parameters). A popular (since very tractable) parametric assumption is normality. In a "normal" world, all risk measures are simply functions of (co-) variance. Variance is a symmetric measure, reflecting downside risk as well as upside potential, and hence only relevant for symmetric distributions. Asymmetric risk measures relate only to the downside: the left tail of the distribution. Examples are semi-variance, Value-at-Risk and Expected Tail Loss. It depends on the nature of the

exposure (long or short) whether the left or right tail of a risk factor's distribution is relevant.

(In-)decent exposure

Risk factors exert their influence on cash flows or market value through different kinds of exposures. Cash flows have a quantity component and a price component (which may decomposed further in prices denominated in foreign currency, and exchange rates against the local currency). In transaction exposures, the quantity component is fixed and only direct price changes account for fluctuations in the cash flow. This applies to relatively short-term cash flows from current transactions, and for this reason these exposures are also termed tactical exposures.

Economic exposure is a broader concept and indicates the degree in which the market value of the firm (the present value of all future cash flows) is vulnerable to risk sources. In the longer term (extending the scope to also include future transactions), price changes not only exert a direct effect on cash flows, but also an indirect effect. Through price elasticities of demand and supply, future price changes also induce changes in quantities. For example, when input prices increase, the firm may reduce required input quantities by increasing efficiency, or look for cheaper substitutes. Alternatively, the firm may choose to pass on increased input prices by increasing output prices. However, this "pass through" may impair the firm's competitive position. Because of its long-term character and the potential consequences for the firm's competitive position, economic exposure is also known as strategic or competitive exposure.

Translation exposure only refers to currency risk and arises when a parent company composes its consolidated accounts. When expressing the subsidiaries' assets and liabilities in the local currency, gains and losses may appear. However, the focus is on book values and not on market values, and the changes in exchange rates have already materialized over the past accounting period, so translation exposure is not a risk exposure in the true sense. At best, translation exposure is an accounting effort to measure economic exposure *ex post facto*.

License to hedge

The goal of hedging is not to eliminate all risks. We should draw a distinction between risks emanating from the firm's core activities, and risks stemming from facilitating activities. Regarding its core business the firm has a comparative advantage and can thus generate value for its shareholders (and other stakeholders). However, to perform the core business the firm must also engage in activities peripheral to the core activities. Examples of these facilitating activities are financing the capital assets (after all, the production process takes time), buying inputs or selling outputs abroad, providing consumer credit, and so on. This exposes the firm to interest rate risks, generates currency risk exposures, and introduces credit risks, respectively. Obviously, the firm has no comparative (i.e. competitive) advantages in these areas and hence cannot expect to add value by running these kinds of risks. But they simply come in a package with its core activities. Since the firm has no discriminating expertise in the field of peripherical exposures it can decide to hedge them.

To hedge or not to hedge?

That's the question, indeed. In a perfect market environment, everybody has the same information at the same time, everybody can fully diversify his or her holdings, and

there are no transaction costs and discriminating taxes. In that sterile environment there is no reason for firms to hedge. After all, shareholders themselves have all possible flexibility to adjust the risk profile of their portfolios to their particular liking. (Un-)fortunately, the real world is not perfect and allows three major reasons for hedging. Firstly, shareholders do not hold fully diversified portfolios; it is even impossible to diversify your human capital across various employers. This implies that the survival of the firm as a separate value-generating entity is important, and hence that the firm protects itself adequately against financial distress. In the short run, financial problems expose the firm to an exodus effect. Stakeholders are no longer prepared to engage in long-term contracts with the firm and leave the sinking ship. This aggravates the difficulties and paves the way to default in the longer run. In addition, there exist information asymmetries between the firm and its stakeholders. When the stakeholders have not sufficient insight (or none at all) into the firm's peripherical exposures, how could they possibly hedge them? So that remains the firm's task.

The bank doesn't bake pizzas and we don't cash checks

Secondly, peripherical risks cloud the stakeholders' view on the success of the firm's core activities. All stakeholders benefit from transparency, revealing the firm's success in adding value by core activities. After all, since the firm has no comparative advantage in the facilitating activities these cannot be a (sustainable) source of shareholder value. Since the financial performance achieved on core activities is confounded by cash flow fluctuations due to peripherical exposures, it makes sense to hedge the latter exposures. In that way, the firm can offer a clean view on the contribution of the core activities. Insufficient transparency may result in a lower market value of the firm (the so-called lemon effect). Not only the disclosure to stakeholders outside the firm is relevant. Within the firm, the planning, management and control of the core business benefit from a clear insight into the value it generates.

It's a long way to Tipperary

Thirdly, entrepreneurship implies (among other things) that the firm adequately reacts to changes in its environment. With the increasing globalization of markets, increased competition and fast changing consumer preferences, the economic environment in which the firm generates its cash flows can change drastically in many dimensions. It is of paramount importance for the firm to know what opportunities and threats lure in its environment, and where its strengths and weaknesses lie to grasp these opportunities and parry the threats. Therefore, a firm must tune its activities to the strategic-dynamic context in which it operates, both defensively and aggressively. The process of strategically aligning the firm's activities is cumbersome, costly and time-consuming. After all, it requires operating on real markets, for example erecting production facilities abroad. By hedging, and especially by using derivatives, the firm can buy time. On the short term it can shield itself from adverse developments, giving time to evaluate these developments in detail and ponder on the available strategies for the longer term. Hedging thus offers the firm tactical flexibility in favour of shaping deliberate strategic policy.

If I were a rich man

The current financial position is an important consideration, if not for hedging fully or not at all, then for the degree of hedging. When the firm has considerable financial buffers in the form of outstanding short-term liquidity and long-term solvency, this

can serve as a cushion to absorb financial losses. For a firm balancing on the brink of bankruptcy, appropriate hedging can make the difference between survival and default.

Through the looking glass

Hedging is part of the more embracing process of risk management and the framing of this process is important in order to fathom the various aspects of hedging. A structured framework for financial risk management roughly comprises the following stages: (1) risk analysis, (2) formulation of a hedging policy, (3) implementation, and (4) performance evaluation and feedback. A flaw in any of these stages impairs the success of the whole hedging process. Let's consider these stages in more detail.

La vie en rose

In the first stage, the sources of risk are identified and the exposures are estimated. For this goal, net cash flows can be broken up into inflows and outflows, and further decomposed according to product, service, geographical area, etc. The identification of risk sources the firm is exposed to is no trifle. Especially economic exposures are difficult to gauge and may take the firm by surprise. The competitive position of the firm can change quickly, revealing risk sources and originating exposures that were formerly non-existent. Scenario analyses may help here, but it is very difficult to formulate a complete set of useful (consistent, mutually exclusive) scenarios. The biggest problem in risk analysis are the "unknown unknowns" (the things you don't know that you don't know, in contrast to the things you know you don't know). The root of this problem can be overconfidence: potential harmful future events are considered "impossible" to happen and hence disregarded as irrelevant. Behavioral finance (now 20 years after the seminal work by Kahneman and the late Tversky firmly established), points at cognitive biases and especially framing effects that cloud the perception and evaluation of risky situations. When realizing the shortcomings of our subjective perception we can look for more objective sources of information.

Dredge before you hedge

The evaluation of the potential volatility of risk sources and the measurement of exposures requires data: high quality, trusted and validated, relevant data. Most information flows within the firm concern accounting data – hence backward looking and relating to book values. It takes considerable efforts to collect real-time data referring to cash flows, cash flow components, and market values. The garbage-in garbage-out principle fully applies and the importance of data as starting point of the risk modeling process cannot easily be overstated.

"In physics, you're playing against God…

…in finance, you're playing against people", to quote Emanuel Derman, former head-quant of Goldman, Sachs & Co, New York (and theoretical particle physicist by training). Data serve as input to models: by definition simplified representations of complex reality. Assumptions are made and relations between variables are postulated. This introduces model risk: functional relationships stipulated in the model may be wrong, or relevant input parameters may be estimated incorrectly. Financial modeling is quite different from physical modeling since there are few, very few, economic laws. The economic reality as captured by models changes continuously, and hence the models are prone to change. The limitations and dynamic

nature of models should be well understood. The mathematics of the models may be precise, but the models by definition are not…

In the line of duty

The stage of risk analysis leads to a risk profile. In the second stage (policy formulation) this profile is evaluated to answer questions such as: what exposures are material and should we hedge, when should we hedge, over what horizon, and how? Micro-hedging (hedging separate exposures before netting them) should be avoided. Moreover, because of the interplay of various risks at the aggregated firm level, risks should be evaluated and managed in a coherent, consolidated and integrated way. This is the focus (and challenge) of enterprise-wide risk management (EWRM). EWRM cannot be conducted from a more or less isolated treasury department but calls for a strategic embedding of the risk management process. Input from higher management levels is needed to evaluate the possibilities and desirability of pass-through: the ability of the firm to pass on increased input prices by raising output prices. This is a strategic decision since it may hurt the firm's competitive position. A broader perspective is also required to recognize natural hedges. A natural hedge arises when exposures inherent in different activities tend to compensate each other and hence require no explicit hedging. For example, an explicit short US dollar exposure can be compensated by the fact that part of sales are denominated in that same currency (implicit long exposure). Finally, the potential consequences of competitors' hedging strategies should be taken into account. Deviating from the sector's "average" hedging policy may result in windfall profits but also losses. This can impair the firm's profitability or hurt its market position.

By any other name….

In the third stage, hedges are implemented. Hedging can take different forms. Perhaps you are inclined to think only of the application of derivatives, but that is only one particular form: financial off-balance hedging. (It is this kind of hedging that is relevant in the context of this journal issue: hedge accounting.) In financial on-balance hedging, the maturity structure and currency of denomination of firm's liabilities are adjusted in order to match exposures generated by the assets. Finally, operational hedging (almost by definition on-balance) implies reshuffling the firm's activity portfolio in order to mitigate exposures (for example using flexible production facilities or moving production abroad).

The Gremlins

Derivatives come in many flavours: plain vanilla (basic derivatives such as forwards, futures, options and swaps) but also hybrid and exotic, such as barrier options (as used in click funds) and energy derivatives (as used by ENRON). When applied correctly, derivatives provide the firm the opportunity to shield itself with almost chirurgical precision from the adverse effects of changing market prices. Applying derivatives for risk management, however, requires a profound understanding of their characteristics, their pricing and last but not least of the markets on which they are traded. The importance of this cannot be underrated because it constitutes the firm foundation for applying and combining these potential hedge instruments in practice: the so-called process of "financial engineering". Several mishaps and outright debacles (think of Gibson Greetings, Procter & Gamble, Metallgesellschaft and Orange County) prove that this is no easy task. In most cases, simple instruments suffice to successfully attain the hedging goals. When more complicated (exotic) instruments are deployed,

be sure at all times to fully understand their characteristics. Otherwise, a “hedge position” may transform itself to into a speculative nightmare.

Cut your cost, not your cover

Buying options (contingent claims in general) requires paying an upfront premium; this in contrast to linear instruments as forwards, futures and swaps. But long options are attractive because they offer upside potential without possible downside losses (apart from the premium). The cost of an option position can be reduced by applying knock-out barrier options; these options cease to exist when the underlying crosses some barrier level. Hedging costs can also be reduced by at the same time writing (out-of-the-money) options. Taken to the extreme, the latter strategy even allows “zero-cost” strategies. However, as a general rule you get the payoff pattern you pay for and zero-cost constructions are only possible by allowing potential losses. When matching hedge positions and exposures, a “cheap” alternative may not be the best.

In a Japanese garden…

… you will find perfect hedges. Only when derivatives are employed of which the maturity coincides with the hedge horizon and the underlying asset matches the exposure, a perfect hedge is possible. (A violation of the latter condition generates the so-called basis risk.) In practice, it will be quite difficult to fully shield the firm from undesired effects of risk factors. When the hedge is imperfect, its performance should be monitored continuously in order to enable timely adjustments.

Play it again, Sam

The fourth and last stage of the risk management process is the evaluation of the hedge performance: did the hedge policy as formulated and implemented yield the desired results? The last stage, however, is not the final stage. In contrast, it provides the necessary feedback to monitor and improve the hedging process. Firstly, relevant risk sources and exposures are likely to change over time, urging the firm to update its risk profile continuously. Secondly, the risk policy needs to be evaluated against changes in the firm’s operations: natural hedges can pop up or disappear, the competitive position of the firm can change, and the opportunity to pass-through potential increases in input prices can improve or deteriorate. Thirdly, after initiation even the implementations of existing hedging programs require continuous monitoring and adjustment.

If I could turn back time

The ex post evaluation of a hedging strategy may be hindered by hindsight. Loosely speaking, the purpose of a hedge position is to compensate profits and losses on the corresponding exposure. So when a loss is made on the exposure, the hedge position shows a profit. Conversely, when the exposure shows a profit, the hedge position is expected to generate a loss. Although the latter may seem disturbing, the result on the hedge position should never be evaluated in isolation but always in combination with the result on the exposure. Indeed, only the result on the hedged net position is relevant (which again points to the importance of hedge accounting). Important is whether the hedge served its purpose, for example fixing prices. When complaining about a loss on a hedge one silently assumes perfect foresight, ignoring other scenarios that could have materialized. But today is yesterday’s future, and hence unknown at that time. And that exactly points at the importance of risk management.

With perfect foresight firms obviously wouldn't hedge – and I wouldn't write this article but enjoy being filthy rich.

Houston, we've got a problem!

Under hedge accounting, the gains or losses on a derivative contract that qualifies as a hedge are recognized in the same accounting period in which the gains or losses from the underlying exposure are recognized. Otherwise, (mark-to-market) gains or losses should be recognized when they occur. This hedge accounting treatment is strictly limited to only instruments that are highly effective in offsetting risk exposures. In sophisticated EWRM, this may carry an unwanted side effect. After all, when a portfolio of exposures is managed (as opposed to separate exposure-by-exposure hedging) there may be no strong relationship between applied derivatives and individual exposures. This could easily disqualify the firm for hedge accounting and hence exert a negative effect on the corporate willingness to use derivatives for risk management.[1]

Hardware, software…

Implementing and sustaining a hedging program along the fourth stages outlined above is no easy task. In each stage of the risk management process careful consideration must be taken towards the adequate organization of the activities. The first issue here is to design and maintain the adequate blueprint of the organization. This refers to the architecture or "hardware" of the firm: who develops, implements and monitors hedging activities, what technology is used, how are functional responsibilities separated between different people, and so on. The second issue is of a "software" nature and comprises the design of adequate information flows between all those involved with hedging. In other words: what are the procedures with respect to consulting, decision-making, control, authorization, reporting and audit.

…& wetware

However, even the finest hardware and software can result in a run time error and frustrate risk control compliance. This brings us to the last issue: the "wetware". Hardware and software (well, all stages of risk management) should be designed to take the human factor into account. There should be adequate communication between all levels of decision making, between the narrow treasury function and higher management levels (up to the board). This communication should be in the form of information that really can be understood by people not directly involved with hedging. A highly sophisticated risk management unit, staffed with rocket scientists and equipped with the most advanced technology, but lacking the ability to translate the Greek alphabet into proper language or unable to transcend above the level of stochastic partial differential equations, isolates itself within the firm. This creates wizard risk and hampers the integration of the risk management function into the firm as a whole. In addition, there should be adequate control of the process, providing valuable feedback to improve risk analysis and management. The firm operates in a dynamic environment and the Darwinian principle to survive is to adapt. This calls for a learning organization. Finally, adequate auditing is indispensable since misuse, abuse and outright fraud lurk everywhere…

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[1] For derivatives and accounting, see for example the brand-new *Journal of Derivatives Accounting* (www.worldscinet.com/jda.html).

A (board) room with a view

By definition, risk relates to unexpected events. It is striking, then, that in practice expectations with respect to the future course of risk factors are sometimes used to guide the hedge – no hedge decision ("selective hedging"). For example, the oil price is currently considered to be at its highest level (or the US dollar at its lowest, cf. BMW) and therefore the corresponding exposures are no longer hedged. The relevant point here (almost of a philosophical nature) is that hedging aims to mitigate risk and risk is simply expectations not coming true. In this sense, expected events may be used as a benchmark against which unexpected events are defined. However, expectation based hedge programs simply miss the point of risk and may leave the firm exposed to nasty surprises. The best we can hope for in a "view" guided hedge program is that the underlying exposure is not quite relevant for the firm (so that in the end it actually does not matter whether the firm hedges yes or no). Especially in the short term, financial markets can be considered efficient, and the potential fluctuations in risk factors (the volatility) dwarf the effect of the expected trend (the drift). Still, the myth of predictability of interest rates, exchange rates and commodity prices is quite persistent. Indeed, it can take some time for risk to materialize and one can be lucky a few times in a row. This may fuel overconfidence and lead to the dangerous situation where plain temporary luck is confounded with sustainable skill.

The talented Mr Treasurer

One question that pops up repeatedly is whether the treasury department should be organized as a profit center or as a cost center. In the former set-up, the budget is not used for executing the risk management function but for taking additional exposures on the financial markets in the hope of reaping rewards. However, unlike proprietary trading of financials, trading on financial markets is not a core business of non-financial corporates. Hence, the firm cannot expect to add value by taking such exposures. Even when expertise would exist to outsmart financial markets, the resulting speculative exposures would surprise stakeholders and may even lead to litigation. Whenever (near-) banking activities are performed, there should be sufficient disclosure to inform stakeholders that they have partly a stake in a financial institution – with all the risks attached. Overall, the question in the beginning of this paragraph can better be rephrased as: "cost center or loss center".

Mission impossible

Finally, financial hedging is no panacea. In market-based economies, changing prices serve as signals to guide the allocation of activities. Financial hedging can postpone the consequences of relative price changes and buy the firm time. But in the longer run, the firm has to abide to the re-allocation of economic activities as signalled by price changes. The strategic management of economic exposures then evolves to entrepreneurship, the *conditio sine qua none* for a successful business. In this context, it is noteworthy that the Chinese use the same symbol for "risk" and "opportunity". Only a savings account is risk free, profit opportunities are by definition risky ventures.

Everything you always wanted to know about hedging…

… but were afraid to ask, you can probably find in:

Smithson, C.W., 1998, *Managing Financial Risk: A Guide to Derivative Products, Financial Engineering, and Value Maximization*, McGraw-Hill, New York NY

Stulz, R.M., 2003, *Risk Management & Derivatives*, Thomson, Mason Ohio

Many other references and links are offered by the *Global Association of Risk Professionals* (www.garp.com) and the *Professional Risk Managers' International Association* (www.prmia.org); see also www.contingencyanalysis.com, www.erisk.com, and www.gloriamundi.org.