DEVELOPMENT AND RISKS

*Financial intermediation and risk management
in the era of Commodore 64 and today*

János Száz

ABSTRACT

The Hungarian banking system has changed greatly in the last 30 years. We could see even greater changes in the type and magnitude of financial risks worldwide. On the following few pages, I will make an attempt at describing where the Hungarian two-tier banking system and securities market started from 30 years ago as well as the main challenges I see today and looking ahead to the near future.[1] But first I would like to address the problems and pitfalls of long-term retrospection briefly.

1 WHAT DOES LONG-TERM RETROSPECTION REVEAL?

With all likelihood, a distorted image.

It has become well-known based on the work of Nobel laureate in psychology *Kahnemann* that the past is recollected in our brain and our decisions are rational in a way that is different from what we would naively think logical. He has provided experimental evidence that when we recall events from the more distant past (e.g. our summer holiday the year before), we remember their beginning, their end, the best and the worst parts, but not really durations.[2] As another important finding, *what is frequently mentioned* springs to mind more easily. To provide an example, imagine that a man cheated on his wife. What do you think is more likely: that he is a politician or a baker? Most probably, we would guess it was an unfeeling,

---

1   This review was written for the 30th anniversary of the foundation of the Hungarian Banking Association, but it is not about the 30 years of operation of either the Association or the banking system. It is purely intended to highlight some characteristic traits of the past and present operating conditions of the banking system, focussing on risks and the general attitude to them.

2   We are gnawing our fingernails with excitement in the third act of an opera to see whether the protagonist can make it to his dying lover in time.

On the other hand, it is of no concern whether he arrives 5 minutes, 5 days or 5 months earlier.

unscrupulous politician rather than a diligent baker. It does not matter that there are far more bakers around[3]. However, there is extensive newspaper coverage of politicians' offenses, which we therefore more readily recollect.

If I would ask now what the greatest (financial) systemic risk was in the last 30 years, I suspect that most people would mention *foreign currency lending*. And few would recall fears of *inflation expectations* spinning out of control in the '90s. It was a long time ago, and eventually, inflation did not get loose. Still, it is much more likely that a sequence of 5%, 15% and 25% inflation is followed by inflation rates of 40% and 60%, rather than a reverse trend. MNB (the central bank of Hungary), governed then by György Surányi, switched from ad hoc and abrupt exchange rate devaluations of a significant extent to a continuous, *sliding devaluation* of extents announced in advance. By doing so, they could reliably bridle and gradually temper expectations.

Of thing past, long-ago risks are especially hard to remember. Even more so, if a risk – although it was serious – finally did not materialise. It feels as if it was not real at all.[4] On the contrary, we take low risks which eventually materialised very seriously now. *Risks* are hard to remember and even harder to *control*. Among other things, because of the reasons mentioned above. I will elaborate on this in Section 3.

One might think that commonly known objective facts and the past organised into data series are easy to survey. For example, which were more dramatic and which were more peaceful times. After all, a fact is a fact no matter how you look at it.

Let us test this hypothesis. Consider the HUF-USD exchange rate over the last decades.

---

3   Even though we consume much more nonsense than bread.
4   There are a few exceptions, though, e.g. the Cuban missile crisis. But it is also true that we can frequently see related short documentaries on various TV channels.

Chart 1
USD/HUF exchange rate at the beginning of the year (at the top)
and HUF 1,000 in USD at the beginning of the year (at the bottom)
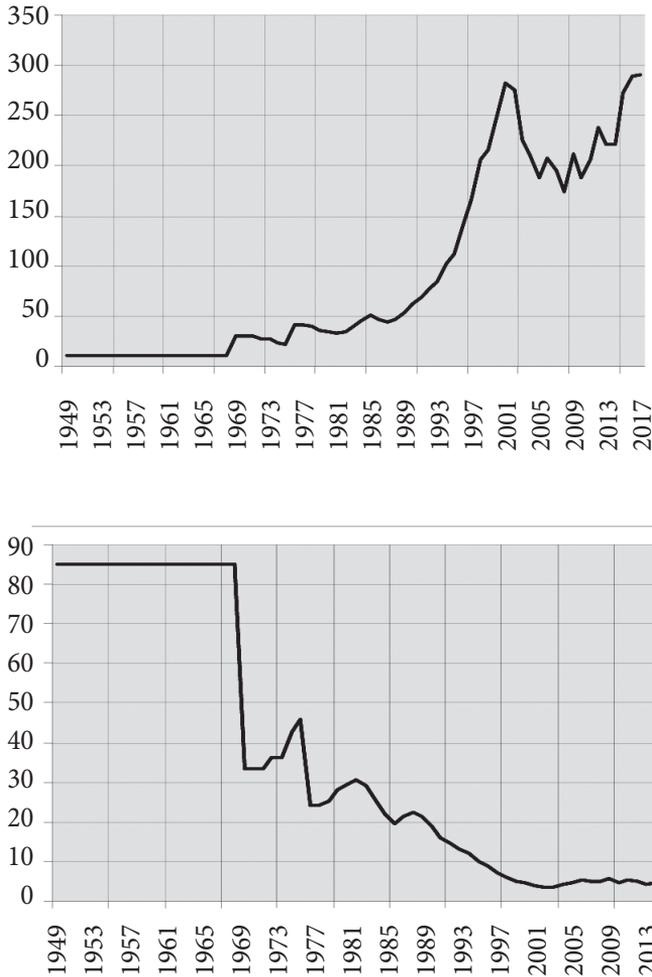
Source: Exchange rates at the beginning of the year, 1949–2017 (MNB)

On the USD/HUF exchange rate chart at the top, the 1968 USD revaluation from HUF **11.74** to HUF **30** is barely traceable. That was, however, the most dramatic event in the history of the inverse exchange rate, shown on the chart at the bottom.

While the drop in the exchange rate from **282** in *2001* to **174** in *2008* is sharp on the chart at the top, it does not leave almost any mark in the chart at the bottom. The same events are perceived differently by an analyst in New York and another one in Budapest, because their points of reference are different.

Any raw exchange rate chart is necessarily distorted, if orders of magnitude change in the meantime. When the Budapest Stock Exchange index (BUX) is considered, the Asian and Russian crises are negligible in comparison with the 2008 recession. The problem is that we cannot gauge by eye that a 10% decrease or increase at the level of thousands is as significant a change as one at the level of thirty thousands. Only, the latter looks 30 times larger on the chart.

Therefore, looking back, even objective data are distorted to some extent and events which were felt serious in their time may lose significance.[5] Roads are getting narrower in the distance, no matter if we look forwards or backwards. How did *Kölcsey* say it? *'Ponder anew why the time is now, compare it well to the future...'*[6].

Or slightly paraphrased: compare the present time to the distant past with circumspection.

Having dealt with the problems of comparison, let us look at the position where Hungarian commercial banks, the stock exchange, and supporting institutions for financial and banking education and research started 30 years ago.[7]

---

5   The appendix to this paper contains some supplementary charts illustrating how relative changes can be emphasised and thereby processes made comparable in time. It is surprisingly easy.

6   Ferenc Kölcsey: *Huszt* (1831, English translation by Watson Kirkconnell and Ádám Makkai).

7   I found it useful to highlight a few elements evoking the atmosphere of the time, which are no longer present but were very much there then (e.g. Soviet military barracks all over the country), or on the contrary, are taken for granted now but most people would not have dreamt of back then (convertibility, bank cards, a passport to the West). Even more important differences are the presence of the *Internet* and forms of communication like PPTs (Power Point presentations).

This short discussion is not intended as an assessment. It is only a recollection of certain processes that the author has actively taken part in or was witness to. For the same reason, the author is required to specify his stance to the three decades under review. He has been working full-time at the Department of Finance of the University of Economics from 1976 (the name of the institution, currently Corvinus University of Budapest, has changed repeatedly over time, just like street names). From 1983, he has been a part-time associate of the Department of International Financial Policy of MNB and then the International Training Center for Bankers. He was on the first Council of the Budapest Stock Exchange (BSE) as a member responsible for training and the development of the examination system, and later, from 1995 to 1996, as Chairman of the BSE. He was a member of the Central Bank Council (now Monetary Council of the MNB) in the second half of the '90s.

2 FROM BUST TO BOOM: IMF, THE TWO-TIER BANKING SYSTEM, THE INTERNATIONAL TRAINING CENTER FOR BANKERS AND BSE

'Damage always comes with a reward' – my old neighbour Mimi used to say. In 1982, several countries around the world were going through a grave financial crisis. Hungary was among the first countries going insolvent in a row as a result of the crisis. It was in this period that *István Szalkai* wrote his 17-page, later classified essay, which was presented also to the Political Committee of the Hungarian Socialist Workers' Party (MSZMP) and based on which Hungary rapidly became the first member country under Socialist rule of International Monetary Fund in the greatest secrecy. According to *Miklós Pulai*, former Deputy Governor of MNB, the IMF membership had been on the agenda since the mid-1960s but was postponed for as long as possible.

It was the first step in the 20-year long process of Hungary's Euro-Atlantic integration and the rise of a different approach to finance in the country. In this period, the *Institution for Financial Research* of the Ministry of Finance, or Financial Research Plc., led by *István Hagelmayer*, was an important hub of intellectual life in finance. *MNB* had unchallenged professional authority both inland and abroad. The *Department of Finance* of the Budapest University of Economics headed by *Miklós Riesz* was also working away. All three institutions were highly progressive, reformist places – downright bold within the Socialist bloc[8]. The bonds issued for the international markets first in the region by MNB and Hungary also counted as a rarity within the Eastern bloc. For a long time after the Soviet army invaded Afghanistan, only MNB could get a Western loan. This was not possible for even the Investment Bank of the COMECON at the time.

These days – mainly because of the influence of television, I reckon – the omnipotent approach of rapid intervention and *immediate effect* becomes more and more entrenched in us.

> *Not only in the case of ultra-fast and effective painkillers: it is as though walnut trees were growing tall instantly. Systems of difference equations analysing delayed effects have faded away from university curricula.*

---

8   At the universities of the Socialist bloc, it was uniformly taught based on *Marx* that *gold* is the absolute money. From Miklós Riesz's coursebook, students could and still learn about the operation of the *modern fiat money system*. He pioneered in teaching what is regarded now as modern banking, which gradually replaced Soviet-type lending practice in the curricula.

At the *History of Economic Thought* course of Antal Mátyás, in addition to the theories of *Smith* and *Ricardo* and the economic philosophy of *Keynes*, *Friedman* and *Hayek*, everyone could get familiar with the basic concepts of modern economics. I still know the definition of marginal rate of substitution, but I have already forgotten its Marxist critique…

It was something of a paradox that we learned modern concepts at a history course, but such were the times. At least we had a possibility to do so, unlike our neighbours.

But spillover effects develop through years or decades, multiply relayed. The *Institution for Financial Research* was a cradle of intellectual thought in the '70s and '80s. It gave almost a dozen Ministers, Central Bank Governors and Deputy Governors, SAO Presidents and heads of financial supervision. Those how listened closely, could recognise the legacy of Miklós Riesz's lectures in the central bank's philosophy under the governance of Surányi. The reasons for Hungary's overwhelming advantage in the field of finance in the '90s over former Socialist countries of the region ran deep.

30 years ago, we were the first country within the region to have a two-tier banking system, a stock exchange or a training institution for bankers and brokers. We were also first to join international professional organisations such as the *EFFAS (European Federation of Financial Analysts Societies)* or the *CEMS (Community of European Management Schools*, now the Global Alliance in Management Education). The first provides access to an international degree recognised in 30 countries and the latter enabled several thousands of Hungarian students already to learn for a semester at the most prestigious European business schools.

All that was not achieved overnight, or as the result of a gentle revolution. István Hagelmayer wrote several articles already in the late '60s about the need to introduce the two-tier banking system.

As a sign of intellectual ferment, *KJK* (Közgazdasági és Jogi Könyvkiadó, Publishing House of Economics and Law) published a series of volumes or anthologies by *Nobel laureates* in economics from the '70s on. The first volume of the series was on *Samuelsonian economics*, which immediately became part of the university curriculum. By making these thoughts accessible, the series implicitly legitimised them since they came from by a state-owned publisher. KJK published the volume *Bonds* [A kötvény], written by *Bánfi*, *Sulyok* and Száz) in 1986, which, in addition to being the first book on securities written by Hungarian authors in four decades, disseminated the criteria, concepts an calculations of investment in bonds to a wide audience. There was no obstacle to its incorporation into the curriculum at the University of Economics and later elsewhere. As a forerunner to the stock exchange, the Secretariat for Securities Trading (Értékpapír-kereskedelmi Titkárság) was established in 1987, led by *Zsigmond Járai*. Initially, it mainly traded city council bonds.

The need for a sock exchange in a Socialist economy was advocated by Tamás *Bácskai* from the early '80s.[9] It is no coincidence that the first stock exchange

---

9   His views evoked a strong response also abroad. He was even invited to Vietnam, but as he was reluctant to have the necessary vaccines and the long flight, it was me who had the chance to hold my very first English lecture to a full house at the National Theatre in Saigon (Ho Chi Minh City). The English Ambassador was sitting in the first row and the Soviet Commercial Attaché was taking notes behind him in the second. Another speaker invited to the two-day event was the International Director of the London Stock Exchange. Despite Hungary's minor significance, it attracted much international attention that a Socialist country was planning to have a stock exchange.

conference was chaired by him in 1989. It marked a breakthrough into public consciousness. For the first time, the stock exchange was mentioned in the TV news as a legitimate institution and not as an imperialist abnormality. The conference was the first occasion that Zsigmond Járai publicly promoted the need for establishing a regulated domestic securities market. Until that day, the word 'stock exchange' was – explicitly – taboo (just like Trianon and 1956). From then on, people and the media could legitimately speak about the stock exchange. There was a considerable trading volume in bonds but shares were yet to come.

The Budapest Stock Exchange was also a pioneer within the Socialist region for years[10], although its Warsaw counterpart soon became a serious rival. Notwithstanding, the BSE was no longer a simple stock market by the mid-90s, but an integrated bond and stock market and a derivatives market, epitomised by the *MMTS* (Multi-Market Trading System) software used at the BSE for two decades. That meant an advantage of several years over the Vienna stock exchange where the futures and options exchange (*ÖTOB*) was integrated only later with the Wiener Börse. Interestingly, it was Vienna where we picked up the first pieces of knowledge about the stock exchange in the late '80s.

Banks and the revived *securities market* had a special relationship. Even in hindsight, it is remarkable that instead of setting up dedicated divisions for securities trading in house, banks had a statutory obligation to establish legally separate brokerage firms and investment banks. They could trade in sovereign debt instruments only through these entities. Banks had enough of that after a time, but still, that initial state of full separation was highly important for the evolution of the securities market. Bank lobby would have been strong enough to avoid this arrangement, but the leaders of the most important large banks had sufficient wisdom and foresight to let legal regulation develop this way.[11] Self-restraint is a virtue at all times and in all walks of life. Pity that it is less and less appreciated in this day and age.

---

10 'Pioneer' should be taken literally. The first stock exchange conference in Romania was organised by the Hungarian student association of the University of Kolozsvár (Cluj-Napoca), in the university hall decorated with flowers. It was covered by Romanian state television. As apart from the representatives of the BSE, MNB Vice-Governor *György Szapáry* and President of the securities authority *Zoltán Pacsi* were also invited, the event was visited also by stakeholders from Bucharest. It was a breakthrough in the development of Romanian markets, similar to that mentioned in the case of Budapest. *Adevarul Cluj* did not fail to point out with disapproval that it was not organised in Bucharest, by Romanians...

11 Even wealthy aristocrats let their heirs go and see the world for themselves for a while. This analogy is fitting also considering that these brokerage firms springing up from nowhere had relatively young leaders, typically in their thirties or forties, while large banks have always been managed by more experienced professionals. This evolving market therefore had a chance to take its own course of development, untouched by intrabank hierarchies. However, some intuitive carefulness might also have been at play. Securities were brand new territory. Moreover, some might have felt it politically risky to trade in these instruments at a large Socialist state-owned bank.

In the '90s, there was a procession of visitors from neighbouring countries, coming to see and emulate the operating model of the Training Center for Bankers, among others. MNB and the Hungarian Banking Association, and in particular Imre *Tarafás* and Miklós *Pulai* provided effective and long-term assistance to the Training Center, the first training institution for bankers in the region. Although it may be hard to imagine now, the liquidity managers of several large banks have met in person for the first time at the very first (*Liquidity management and monetary policy*) course of the Training Center. While today everything is interconnected through a thousand different channels (mainly electronically), everything was in a nascent state back then. After the development of the two-tier banking system, the necessary commercial banking know-how was imported by Hungarian banks jointly, in close cooperation ('alliance') based on mutual support. The Training Center for Bankers was a practical tool that banks established jointly for this purpose.

3 ON RISKS

3.1 Chances of regulation
in an increasingly unpredictable and rapidly changing world

Means of central risk[12] management applied in the world naively and with high hopes for a long time were the *pegging* of rates (i.e. the currency regime backed by gold, established at the end of WWII in Bretton Woods and used until the early '70s) or the *interest rate cap* used in the USA, complemented by a restriction on paying interest on sight deposits.[13] These initiated an endless cops and robbers game between regulators and the regulated entities, which is euphemistically called '*financial innovations*' or '*financial engineering*' in the literature.

> *The first marvellous invention for bypassing the regulation were **overnight repos**. Is it forbidden to pay interest during the day on sight deposits? No problem. Let's sell sovereign bonds to clients overnight and conclude a next-morning forward repurchase agreement at a set price so that depositors earn their daily interest from the difference between the sale and repurchase price.[14]*

---

12   Of the numerous types of banking risks, the following paragraphs will be restricted to a discussion of changes in market risk over the last decades, which is a well-defined problem, with abundant data available. This does not mean that I underestimate the significance of operating (IT), credit and other risks.

13   Under the Socialist regime, everything had a fixed price for a long time. The interest payable on residential deposits was fixed for decades at 2%, 3% and 5%, depending on maturity.

14   There was a laxative commercial in Hungary before the war: '*While you are asleep Darmol does the trick*.' Maybe this was the inspiration for overnight repos.

Attempts at stricter regulation of the market multiply the number of products that cunningly get around the current rules. The emerging newer and newer products not only puzzle clients, but regulatory authorities may also be late to recognise their substance and the associated risks. What is worse, even corporate control systems may lose track of what is going on within the company. There are quite a few notorious examples to mention.

Derivatives, these exotic products of highly obscure content are the number one instruments to wrap up or mask certain transactions.

> *Let us take the simplest example. When lending is prohibited between two market participants, a very deep in-the-money **put option** is a perfect solution to circumvent the prohibition. The price of such an option is basically the present value of the exercise price. It is paid up front by the buyer of the option, who receives the exercise price later at expiration. There are no irregularities involved. And the underlying asset can be anything.*

Derivatives are not invented for the sole purpose of circumventing the rules. While in theory, they should minimise risk, they would not have sufficiently liquidity but for the activity of speculators. They can reap tidy profits[15], partly because they are typically high-leverage instruments and partly because their pricing entails a possibility to take advantage of better information[16].

3.2 Theory and practice

The basic terms that come up today at university courses on investment analysis are arbitrage, martingale and the *Wiener process*. The last term stands for a continuous-time stochastic process, in which every point is a breakpoint. In other words, it follows an infinitely jagged path. Zooming in on smaller periods in stock price and exchange rate graphs, we see that they do not flatten out and the zigzag motion remains.[17] Any small section of the trajectory of a Wiener-process is infinitely long with jumps on jumps on jumps, etc.

This is all good and certainly very intriguing for some professionals, but why is it important? Personally, I also thought of it as a highly abstract mathematical

---

15   In some cases, at minimum risk; see the case of LTCM.

16   To put it simply: one can always find a poor fool who buys into the highlighted benefits of a gamma swap.

17   In this sense, exchange rates exhibit fractal behaviour. Those who are unfamiliar with the subject may gain quick and spectacular insight into it by typing the search term 'Koch curve' into Google and looking at the related drawings.
While drawing the section of a parabola back in school took a single stroke, even the smallest interval of a Wiener process would use up an infinite number of pencils since it is infinitely long because of the constant jumps in random directions.

construct, which is of primary interest for particle physicists willing to describe the motion of tiny particles. Until a hot summer day on which I was requested to advise on one of the brokerage firm scandals of the recent past. The question to be answered was whether the figures sent by the fraudulent company to its clients on a monthly basis were realistic.

Let us have a closer look at this question. It is one that may rightly be asked in the case of a deposit. For instance, if its annual interest rate is 12%, is it realistic that it earns 8% in 3 *months*? Obviously not. However, if we talk about a stock with an annual expected interest rate of 12%, is 8% interest in 3 *days* realistic? That is where the hitch is.

What my calculations made on the basis of historical end-of-day stock quotes revealed on that hot summer day was that it is not only possible, but that there is a positive probability for even a 100 or 10,000 times that figure. Change in the Wiener process is infinite. Each outcome within the process needs to be interpreted in terms of the probability of the observed outcome. However, the probability of each possible outcome within the Wiener-process is *zero*, but one will certainly occur.

At this point, lawyers and accountants would certainly stop and call it a day. They are dealing with facts.[18]

Before discussing the accountant's perspective, let us have a closer look at the numbers.

Between January 1991 and July 2007, the daily closing price of the BUX index soared from 1,000 to 30,000.

*Those who invested HUF **1** into BUX at the beginning of that period, and did not do anything during the 4,115 trading days, ended up with HUF **30**.*

Let us plot the development of the BUX index with its daily motions arranged, i.e. instead of alternating losses and gains, great gains come first and then losses follow from small to great. As a result, the BUX would look like this (only the first and the last value corresponds with the actual BUX time series):

---

18 By contrast, years after the tragic event, a court panel is still mulling over why so many high schoolers died in a bus that had caught fire. Would there be a judgment by now, if by a great stroke of luck, the bus had not caught fire, even though the catastrophe was going to happen with almost absolute certainty?

Chart 2
Development of the BUX (1991–2007), with daily motions arranged
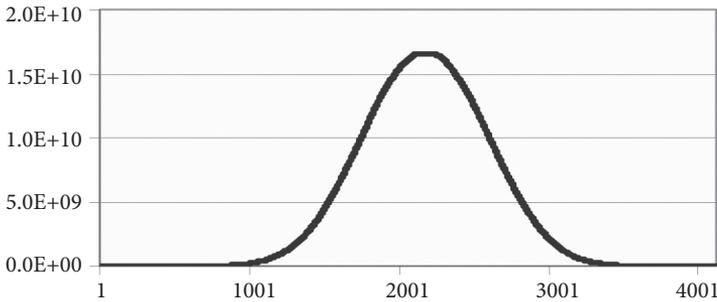
*The chart does not show that the right end of the curve is 30 times higher. So great was the magnitude of the incurred losses and gains. If someone could foretell on which days would the stock market go up and opened a long position on these days only to close it at the end of the day, they could have made HUF **16.5 billion** out of HUF 1 (1.65×10^{10}, with previous gains also reinvested). This means a tenfold increase of more than 10 times.*

*Of course, someone who guesses correctly on which days is the stock market up (52% of the trading days under review) also knows on which days it is down. If they opened a short position on these days, they would have made a total of HUF 9.1×10^{18}. In other words, short selling would result in an **additional** tenfold increase of **8 times**.*

These are inconceivable amounts[19]. If our investor decided to divide one thousandth of the accumulated wealth to 10^7 (ten million) fellow countrymen, each of them would receive HUF 9.1×10^8, .i.e. HUF 910 million.

As good as the story is, it has a certain probability. The probability of acquiring such an enormous wealth is the same as that of having 4,000 correct guesses of heads or tails.

The parable above, based on actual data, illustrated that huge profits can be made on the market, but with very low probability. We also know since Kahneman that the human brain is especially insensitive to low probabilities, and in general, it is intuitively unable to cope with uncertainty. But these are at the very heart of the question. What is the extent that already counts as unrealistic?

---

19   And we did not even consider possible gains from intraday price fluctuations. Now let us imagine all these on a millisecond scale in high-frequency trading.

To move on to the accountant's perspective, let us take a big leap back into the past to medieval Italy.

3.3 Luca Paciolo (1494) and the problem of the points

Luca Paciolo was a Franciscan friar (he also collaborated with *Leonardo da Vinci*). In his book *Summa de arithmetica, geometria, Proportioni et proportionalita*, published in 1494, he discusses, among others, the following problem:

> *Two people are playing heads or tails. One of them wins if it is head and the other one if it is tail. The player who first obtains 6 successes wins the money they have jointly paid in. The game is interrupted at the state of 5:3. How the money should be allocated fairly?*

Paciolo's solution (5/8 and 3/8) was completely in line with his accountant's perspective based on past facts. It is not without reason that he is considered the inventor of double-entry accounting and thus the father of accounting. Only, his solution is wrong.

150 years later, Chevalier *de Méré* posed the same problem to *Blaise Pascal*, who, in correspondence with *Fermat*, provided a solution (7/8, 1/8), creating the concept of expected value.

Paciolo worked on the basis of past facts. The starting point for the correct solution worked out by Pascal were the possible results the players could expect at the current state of the game if it was continued.[20] This is where an increasingly deep and wide gap lies today between risk analysts studying *future possibilities* and accountants and lawyers focussing primarily on *past facts*.

> Maybe it was this conflict that recently ushered in the notion of market value in accounting, which is quite alien to the traditional accounting paradigm. Concepts belonging to the realm of probability theory have become increasingly frequent also in the legislation. Regretfully, probability theory as a distinct discipline has vanished in recent years from Hungarian tertiary education in economics.

---

20 In our example, if the game was to continue, it would end after three more trials at most. The player at a disadvantage could win only if he was to succeed in all three trials. Otherwise, his counterpart would obtain the required number of successes. His odds of succeeding in all three trials are $1/2^3 = 1/8$. Accordingly, the odds of the other player are 7/8.
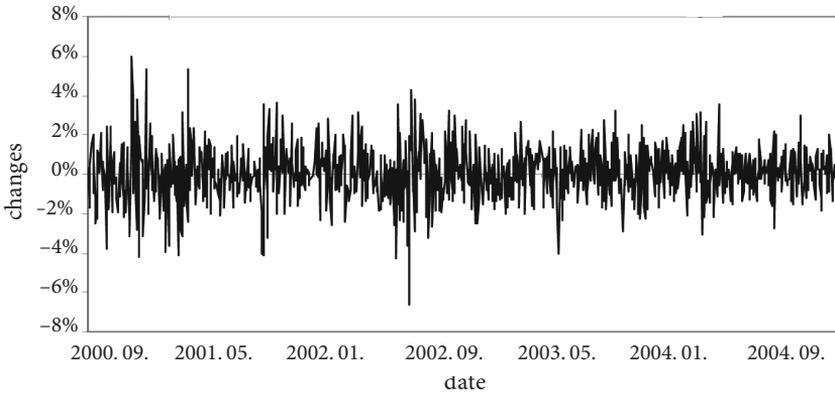
The problem was originally rendered in more abstract terms, but I did not want to abuse readers' attention and patience, and therefore provided a simplified example with concrete terms. For more detail, type 'Problem of points' into Google.

How does exchange rate risk look like?
Like this? Like an ECG?

Chart 3
Intra-day stock price movements

Those who see risks like that must not have had many second thoughts about taking out a foreign currency loan. Yes, there certainly is some fluctuation, but what goes up must come down.

Prospective foreign currency borrowers must have been more careful if they had seen a chart like this:

Chart 4
Daily USD/HUF exchange rates from 1999 to 2005: 220 → 320 → 180

What can be concluded from the chart above is that while the exchange rate rose from **220** to **320** in less than **2 years**, it took 4 years to sink back to **180**. I reckon that placing 20 billboards with this chart along the roads of Hungary would have done more to raise awareness in the early days of FX lending than the pages and pages of fine print inserted into lending contracts.

But these days, regulation gets increasingly bulky, ***going into ever more detail.*** It is getting harder to find out what a drug is actually good for from the longer and longer medication package inserts. Their true purpose is to prevent legal disputes. My favourite one is the following warning in the package insert of a painkiller for headaches: '*it may cause a headache*'. It was on purpose that I provided examples from fields other than finance.

'*You shall not kill*' is concise and clear. However, such a phrasing is no longer considered professional.

3.4 Gamma swap

Anyone can notice that *computers* and the *Internet* have made trading and settlement incredibly fast and they have practically removed geographical borders. The workings and effects of computer-controlled automated *trading strategies in a milliseconds environment* are hard to grasp. But we all know that they exist.

By contrast, few banking professionals and securities market participants are aware of the fact that dozens of university graduates are writing their thesis each year in subjects like *The effect of jumps on a down corridor variance swap*, packed with integrals and stochastic differential equations. They understand the formulae well but often forget to mention what market participants entering into such swap transactions actually buy. Common reference literature are the *Volatility Investing Handbook* (BNP Paribas) and similar works.

What is the subject-matter of a gamma swap? See below:

$$Gamma = \begin{cases} \frac{AF}{M} \cdot \sum_{i=1}^{M} \left[\ln \left(\frac{S_i}{S_{i-1}} \right)^2 \cdot \frac{S_i}{S_0} \right] & \text{, in discrete-time} \\ \frac{1}{T} \int_0^T \sigma_t^2 \frac{S_t}{S_0} \, dt & \text{, in continuous-time.} \end{cases}$$

I wish to quickly reassure readers who may be losing their patience or starting to lose track that they are not alone. Do people really have to trade in these things?!

I have no idea what kind of billboard would be needed to call unsuspecting clients' attention to the kinds of risk these transactions entail. Not to mention parents sending their children to university to obtain a degree in economics but they leave it as gamma traders. They will make good money at least.

We no longer invest in the textile or pharmaceutical industry but in volatility. Which itself would not be a problem if it was complemented by extensive professional knowledge in economics. But that is not the case.

I am sure that readers would be sceptical upon hearing that there are only a handful of young economists these days. I mean economists with a public policy orientation.[21] Secondly, there is an increasing difference between the studies of a student of finance learning the mathematics of derivatives, an ordinary student of business administration and management and a securities lawyer. Surprisingly, studies in mathematics in general and in probability theory in particular are gradually disappearing from Hungarian tertiary education in economics at a time when the financial environment becomes more and more risky. The fact that about two soccer teams of students study in-depth, highly abstract mathematics does not really make a difference. Back in 1920, the Palatine Joseph University of Technology and Economics (a predecessor of Budapest University of Technology and Economics) was the first university in Europe to offer a business programme in which statistics and probability theory were taught as individual subjects.[22]

It is untenable to leave thorough technical and mathematical knowledge to became a private matter of a few professionals. In her 2012 book *Quiet*, *Susan Cain* concluded that one of the main reasons behind the 2008 crises was that extrovert managers failed to listen to introvert analysts. She cites the space shuttle Challenger disaster as an example, where experts warned that there will be sealing failures in temperatures below zero. The development path financial markets take may be regarded as scientists' business only as much as global warming or environmental pollution.

---

21 Economists who are concerned with unemployment, inflation and current account deficit and had corresponding studies at the university. They are an endangered species, closer to extinction than snowcap hummingbirds in South America.
Almost all bigger Hungarian cities offer a training programme that awards a degree in economics, but these are all popular fast-track programmes in tourism and hospitality, marketing, change management or communication. By contrast, the monetary policy study track could not be launched at the University of Economics due to lack of interest. Student grants offered by MNB put an end to that unhappy situation.
22 'There was no country other than Hungary in continental Europe, where there was systematic teaching of probability and statistics as early as 1920' (www.encyclopediaofmath.org),

4. IN SUMMARY

The domestic banking system and securities market has evolved significantly in the last 30 years. Queuing before bank windows for hours with no chairs around, just like in a post office, is now the distant past. Debiting your bank account with your parking fees or train ticket is just a few taps away on your smartphone and you can pay by your Hungarian bank card in a Vienna coffeehouse.

But we all know that where there is light, there must be shadow. The greatest risk today is posed by the array of banking products which have been developed with the express purpose of risk management. It is not without reason that they are called toxic assets. Of course, it is not the products that are inherently toxic, but the way they are used. Let me cite Sándor Lámfalussy's views from a lecture he held at MNB in 1997: *'Nowadays, there is a hype about dandy derivatives in university education. It is time to shift the focus of teaching back onto "**normal, regular, boring banking**".'* His words surprised me then but I think I understand now why he called for caution.

The fate of banks in the future (or in the next 30 years, if you like) will depend, in addition to numerous other factors, first and foremost on future bankers and bank supervisors.

We have ample cause to be hopeful and also to be worried.

APPENDIX

Supplementary charts
Relative changes in the USD exchange rate and the BUX index in the long-term

Chart 5 shows the development of the daily closing prices of the **BUX** index over a 22-year period. Based on this chart, it is hard to believe that the BSE index was the second most rapidly growing stock exchange index in the world in 1996. Unlike this chart, the lower logarithmic scale does not play down the significance of developments in the 1990s. The chart at the bottom indicates ***how many times*** the baseline value of the index ***has doubled*** until a specific point in time.

Chart 5
Development of the BUX on the first 5,500 trading days

Source: portfolio.hu

Chart 6
Development of the BUX quotient logarithm

In the 3 years from March 1995, there was a progress of almost **3** along the log scale, i.e. the index has grown *almost eightfold*. During the 5 years of the great boom between 2002 and 2007, there was a progress of slightly above 2, i.e. there was 'only' a slightly more than *fourfold* increase in the index value. Only the log scale shows that the boom is fairly flat.

Let us get back to the problem discussed at the beginning of this paper: what does the exchange rate chart of a ***currency*** suggest? The inverse exchange rate chart sends a wholly different message about significant exchange rate fluctuations. It makes the issue even more complicated that the inverse of the expected exchange rate is not equivalent to the expected value of the inverse exchange rate.

In other words, when it is equally probable that the USD/HUF exchange rate will be **180**, **200** or **220**, it can be expected that it will be **200**. If the current exchange rate is 200, a change is not to be expected. The inverse exchange rate behaves differently. Using the values above, the value of HUF 1,000 in USD may be 5.56, 5.00 or 4.55. The corresponding expected value is **5.03**, so an American analyst would forecast that the HUF will ***appreciate***, while a colleague in Budapest would expect ***no change*** (Siegel's paradox). [23]

---

23   One of the analysts considers the exchange rate a *martingale* (the expected future exchange rate is equal to the current exchange rate), while the other does not. Martingale is a key concept in modern financial mathematics. The martingale property of a process decides whether *arbitrage* is possible. In our example, the two analysts completely agree about possible values and their probabilities, and there is no conflict between them in terms of political views or interests. And yet...

The log scale does not only allow for a more realistic comparison over time but it also makes it irrelevant whether we look at the dynamics of the USD/HUF exchange rate or its inverse. Sign will be the only difference.

Chart 7
Base index of the USD/HUF exchange rate and base index
of the value of HUF 1,000 in USD on a logarithmic scale
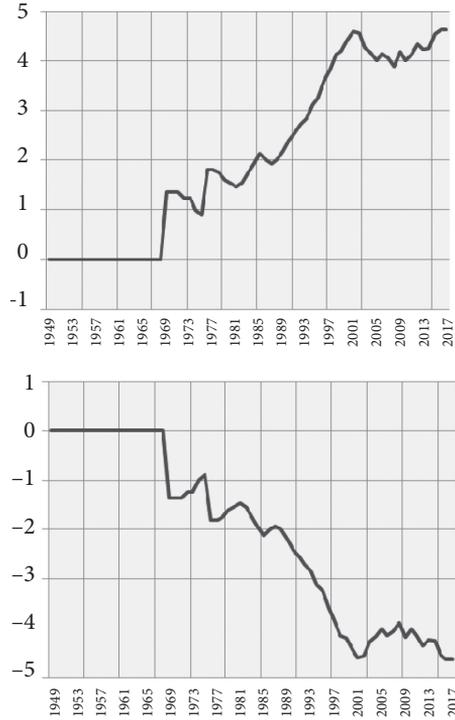
Moving one mark up in the chart at the top, the USD/HUF exchange rate doubles. Moving one mark down in the chart at the bottom, the HUF/USD exchange rate halves.[24]

Maybe so many charts in such a short paper made readers weary, but let me remind them of the truth in the old Chinese proverb: *A picture is worth a thousand words.*

If we look at it closely.

---

24   Charts 6 and 7 are binary logarithms of the base index of the exchange rate concerned and therefore focus on doubling and halving in the exchange rate value.