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Fat tails and the history of the guilder

Casper G. de Vries*

This article reviews the history of the guilder as a way to describe the behaviour of speculative prices. We pay special attention to the extreme movements caused by the fat tail nature of the distribution.

Extremes and Extremists

Financial markets are still reverberating with the aftershocks of the extremist attacks in New York and Washington. Seldom does bad news travel alone, and subsequent abnormal movements in asset prices have wrought havoc with investors. Financial history reveals that such episodes of financial turmoil exhibit a number of common features. As has been seen in the recent period of turbulence, asset price gyrations appear extreme and tend to come in clusters rather than being one-off events, regardless of whether the data is analysed on a minute-by-minute basis or only once per year.

Consider the respectable 400-year history of the guilder-pound exchange rate by way of illustration (see figure 1). The earliest recorded contracts date back to 1609; the data for the first 300 years are summarised in Korthals Altes (1996) and were transcribed from the weekly “Beurscourant” by Posthumus. Gaps are due to lost editions and suspensions of trading due to war.

Some historic episodes are clearly recognisable. The stability due to the gold standard from 1875-1914 and the two short-lived restoration periods after both world wars show up as nearly horizontal lines. Over the last century, the Bank of England almost deterministically revealed her true colours as an agent of the Treasury, since the pound slid down along a near straight line. Unlike their frugal Dutch counterparts, English governments could not withstand the seductions of fiat currency and came to regard monetary policy as the domain of the government. A fiat currency’s value is largely determined by the expectations (trust) about the intentions of the (fiscal) authorities. Only when the UK government in 1997 disposed of their keys to the printing presses (seignorage tax), did the century-long slide come to a halt.

The first figure also shows that the Napoleonic wars and the world wars, together with the depression and the post Bretton-Woods free float era, are responsible for most of the turmoil. This can be seen even more clearly if we plot up the squared returns as an indicator of volatility. In figure 2 we see that some periods clearly stand out from the rest. This is the well-observed clustering of volatile episodes and periods of quiescence that was first observed by Mandelbrot (1963). Later, Engle (1982) proposed an attractive autore-
gressive scheme, dubbed ARCH, that could both exhibit the predictability in volatility, while retaining the zero mean for the returns reflecting the absence of arbitrage opportunities. The ARCH scheme is now widely used by practitioners (such as option traders) to hedge their positions.

**The Droste Effect**

Interestingly, the clustering of low and high volatility is present in the data, no matter what level of detail we choose for examining the data. Consider the plots for the monthly returns from 1766-2000, and the weekly returns from 1915-2000 below. If we compare these two figures with the previous plot for the yearly volatility, we see a very similar picture after we adjust for the scale. The bouts of volatility come in clusters—regardless of the frequency of observations. Moreover, two or three outliers that determine the scale of the vertical axis dominate each graph.

The remarkable observation we take away from these three figures is that volatility is self-scaling. In Dutch scientific slang, this is often referred to as the Droste effect, reminiscent of the nurse carrying a cup of hot chocolate and a can of Droste displaying a label with a picture of the same nurse, ad infinitum. No matter how much we zoom in or out, the same pattern in the data appears.

**Fat Tails**

Before we can understand this self-scaling, we have to discuss a property of the unconditional return data. In almost all sciences the normal distribution is widely used because averages have a tendency to be normally distributed. Furthermore, the normal distribution is the only finite variance distri-
bution that is self-scaling. Is it thus an obvious candidate for modelling financial returns? Below are histograms of the daily returns since 1971 (figure 5) and the yearly returns since 1609 (figure 6), overlaid by the bell-shaped normal density curve estimated from the mean and variance in the sample.

As is clear to the naked eye, the normal model fails miserably. Relative to the normal, the empirical density is too peaked, and has tails that are too fat. Mandelbrot (1963) initially proposed a model that would preserve both the self-scaling nature and the fat-tail feature. But the infinite variance assumption that comes with this model imposes too much tail fatness and does not generate the observed clustering of volatility. The three data features can be reconciled, however, if we drop the self-scaling requirement for all the data. It turns out that the clustering and the fat-tail property are commensurate with the self-scaling, if the latter property only applies to the tail area. This brings us to the work of...

Pareto
Motivated by the social debates of his time, Pareto (1896) discovered a remarkable time invariance regarding the distribution of the highest incomes. His law survives today as the well-known Pareto distribution in statistics. Suppose we adapt Pareto’s law to describe the distribution of the loss returns $X$

$$\Pr\{X \leq -x\} = ax^{-a} \quad \text{for} \quad a > 0, \quad x > a^{1/a}$$

Note that the $x$ represents losses, and $\Pr\{X \leq -x\}$ stands for “the probability that the return $X$ will be less than $-x$” (i.e. a loss greater than $x$). One can understand why these distributions are fat tailed, since integration shows that moments larger than $\alpha$ are unbounded due to the explosion of the argument as $x$ tends to infinity. Note that if we take logarithms on both sides of this equation, we obtain a linear relationship between the log-returns and their log-frequency with slope $-\alpha$

$$\ln \Pr\{X \leq -x\} = -\alpha \ln x$$

What do the financial data tell us?
We first plot all the monthly loss returns logarithmically transformed against their log-rank order, when ranked in descending fashion (see figures 8 and 9 on page 6). The second plot zooms in on the 50 highest losses only. If Pareto’s model applies, one should see a straight line. It is clear this only applies for the latter diagram, which gives a regression slope coefficient of $\alpha = -2.26$, implying that moments up to the variance do exist, but the skewness may very well be unbounded.

Trinity: Fat Tails, Clustering and Scaling
The three asset return data features can now be brought into agreement with each other if we assume that the tail of the distribution behaves like the Pareto distribution. This is similar to the case of the income distribution, where the Pareto model is known to fit well only for the highest income brackets. First, there are many fat-tailed distributions, such as the Student-t distributions, which exhibit the Pareto law as the first term of a (Taylor) expansion of the distribution in the tail area, but which are quite different in the centre. Second, our theoretical research has shown that the distribution of the extremes from an ARCH process, which does model the clustering of volatilities, indeed adheres to the Pareto-in-the-tail model (see De Haan et al. (1989)). Third, for some time it has been known that if a distribution satisfies the Pareto model in the tail area, then
for large $x$, the sum of two independent draws from such a distribution satisfies

$$\Pr[X_1 + X_2 \leq -x] \approx 2ax^{-\alpha}$$

Compare this result with the first equation: Except for the factor two, the right-hand sides of both expressions are equal, implying self-scaling (with factor $2^{\frac{1}{2}}$). Recall that log-returns are additive (i.e. the yearly return is just the sum of the monthly returns), and the relevance of the scaling feature becomes evident. Only recently has it been shown that this scaling also holds if the draws come from a process like ARCH, when the returns are time dependent (see Basrak et al. (2000)). Nowadays, the Pareto-in-the-tail model is often used in risk-management systems deployed by the larger commercial banks to calculate their risk exposure to extreme events (see Danielsson and De Vries (2000)).

The self-scaling feature is exploited to reduce the computational burden, since the exposure has to be computed for different investment horizons. New estimation techniques go far beyond the simple graphical procedures employed in the current essay and allow us, for example, to discern where the tail begins, based on a trade-off between bias and variance (see Danielsson et al. (2000)).

Finally, why do economic data exhibit the fat-tail property? Suppose, for example, that the asset price is uniformly distributed on the unit interval. It follows that the gross return, which is just the ratio of two consecutive prices, has a fat-tailed distribution (with $\alpha=1$). While this explanation is clearly far too simple, current research is actively addressing this question with elaborate models. The academic programme is a never-ending tale, sometimes light and sometimes heavy.

I am grateful to Willem Korthals Altes, Martijn van Harten and Nora Plaisier for collecting and sharing data. The article is partly based on a joint project commemorating the demise of the guilder. The technical statistical work owes much to the numerous researchers at Erasmus Universiteit Rotterdam working on extreme value theory.

**References**


Pareto, V., 1896, La Courbe de la Repartition de la Richesse.
Policy makers have become increasingly interested in topics like employability and lifelong learning. The Dutch government even organised a “national programme of action” concerning these issues. This led to policy measures intended to stimulate participation in training. These measures are based on the premise that there is severe underinvestment in training and that the returns to training are substantial. Yet, results of recent research lend little support for this assertion. Firms and workers seem to be able to solve the underinvestment problem without any governmental intervention. Moreover, the returns to work-related training are likely to be much smaller than earlier studies suggested.

Why would there be underinvestment in training?

Becker (1962) laid the foundation for the economic analysis of work-related training. He introduced the distinction between general and specific human capital. General human capital enhances a worker’s productivity, regardless of the particular firm for which he works. Specific human capital, on the other hand, only enhances productivity if the worker stays with the current firm. The economic implication of the distinction is that since workers are able to reap all the benefits from general training, they should have to bear the full costs of training. In contrast, firms and workers should share the costs and benefits of specific training.

Underinvestment in general training might occur when workers are liquidity constrained (so that they are unable to bear the costs). When the worker’s current employer pays these costs, the worker has an incentive to leave once the training is finished. This is the case because other employers who did not pay for the costs of training are ready and willing to pay a wage exceeding the wage offered by the current employer. This mechanism is often referred to as poaching. Anticipating this, the current employer will not pay the costs of training.

A first thing to note is that underinvestment in general training can only occur when workers are liquidity constrained. But even in that case, there are some clear strategies to prevent poaching. One is the use of payback clauses; if the worker should leave the firm within a specified period after the training has been completed, he agrees to remit (a part of) the training costs. Another solution is the use of sectoral training funds; all firms within a certain sector pay a percentage of their payroll to the sectoral fund; when they encounter training costs, they send the bill to this fund. Both solutions are used in the Netherlands, and they seem to work well.
Underinvestment in specific training might occur due to the *hold-up problem*. This occurs when, in situations in which the investment is not contractible, and in which renegotiations are possible, non-investors are in a position to appropriate a part of the returns to the other parties’ investment. The investor thus bears the full cost of the investment, but receives less than the full benefit. Consequently, (s)he has no incentives to choose the first-best investment level.

A growing theoretical literature analyses different solutions to this underinvestment problem. Among these are the following: structuring the renegotiations stage such that the investor becomes a residual claimant, removing opportunistic behaviour of the employer by introducing up-or-out contracts, and stipulating in the contract penalties for parties that breach the contract.

**Evidence from experimental studies**

To examine how these (sometimes very subtle) solutions work, we conducted a series of experimental economic studies (Oosterbeek *et al.* 1999, Sloof *et al.* 2000, Sloof *et al.* 2001, and Sonnemans *et al.* 2001). Experiments allow us to test the predictions of well-articulated formal theories in a controlled environment that allows the observations to be unambiguously interpreted in relation to the theory. The key finding of the experimental studies is that underinvestment due to hold-up is often much smaller than theory predicts. The theoretical predictions are based on a model in which agents are utterly selfish. This implies that non-investors are prepared to take advantage of their bargaining position once the investment costs are sunk. But this is not what we typically observe in the laboratory; subjects usually reveal reciprocal behaviour. This means that they are prepared to forgo some financial gain in order to reward the fair behaviour of others or to punish unfair behaviour. In some of the experiments, such responses support outcomes that deviate from the theoretical predictions and enhance efficiency. It is important to note that subjects in the laboratory already reveal such behaviour. In our experiments all subjects are completely anonymous, and considerations regarding reputation are absent. In real employer-employee interactions, where such considerations do come into play, deviations from theoretical predictions are likely to be even greater.

**Experimental studies suggest that underinvestment due to hold-up problems is often much smaller than theory predicts.**

**New results on the (wage) returns to training**

An important piece of empirical evidence in favour of the presumed underinvestment in training is found in the very high wage returns to training that are reported in some studies. An example is Frazis and Loewenstein (1999), who find an 8 percent wage increase for 40 hours of training. Many of these estimates seem to be biased, however, because they do not take proper account of the non-random assignment to training. This means that firms are likely to offer training to those workers who might benefit from it, and only workers who think it is worthwhile will follow the training. This is of course a standard (self-)selection problem that hinders causal inferences. In the related field of measuring the returns to (formal) schooling, much progress has been made during the past 10 to 15 years. For decades it has been thought that the typical OLS estimate of the return to schooling overestimates the true return to schooling. Recent studies using data from identical twins and from natural experiments strongly suggest that this is not the case (see Card 1999 for a review).
In a recent paper, we exploit a discontinuity of the Dutch tax system to identify the effect of training on wages (Leuven and Oosterbeek 2001a). In January 1998, the Dutch government implemented a new tax law permitting extra tax deductions to firms for their expenditures on training. One part of this law specifies an additional deduction for training expenditures pertaining to workers aged 40 or older. This additional deduction makes it 14 percent cheaper to train a worker who is 40 years or older than to train a younger worker. Being 40 years or older then serves as an instrumental variable that can identify the causal effect of training on wages. When we take narrow samples around the discontinuity of 40, workers older than 40 are the treatment group and workers younger than 40 represent the control group. The age-dependent tax law serves as the random device that sorts workers into the two groups. It turns out that being 40 years or older is a good predictor of training participation. For samples close to the age of 40, the difference in training rates is 15 to 20% in favor of those older than 40. Using predicted training participation as the instrumental variable in the wage equation gives an estimated wage return to training not significantly different from zero.

Moreover, the high wage returns to training found in earlier studies, which have been interpreted as evidence of underinvestment, seem to be seriously biased. Thus, the Dutch government seems to have little reason to subsidize training activities in the private sector.

**Notes**

1 In this contribution, the term “training” refers to work-related training followed by workers who have a job. It does not refer to training programs for unemployed people.

2 Until recently, it has been thought that the difference between the two types of training is determined by the contents of the training course. Stevens (1994) and Acemoglu and Pischke (1999) have shown that labor market imperfections may render training that is general in a technical sense, into training that is specific in an economic sense.
An interview with Prof. Dr. Piet Rietveld

Piet Rietveld is Professor of Transport Economics in the Department of Spatial Economics at the Vrije Universiteit in Amsterdam. After receiving his Ph.D. in economics at the Vrije Universiteit in Amsterdam, Professor Rietveld worked at the International Institute of Applied Systems Analysis in Vienna, and was research co-ordinator at Universitas Kristen Satya Wacana in Salatiga in Indonesia. Currently, he ranks among the most productive economists in the Netherlands and is Fellow at the Tinbergen Institute.

Transport obviously comes in many shapes and forms and has developed rapidly in the past. Have economists studying this sector been able to keep pace?

Transport is a field of economic research where key concepts and methods were developed and applied for the first time-like consumer surplus, and the logit model. For instance, the concept of ‘consumer surplus’ stems from the 19th century and was developed by a French transport economist who studied the construction of channels. A more recent example is Daniel McFadden, who received the Nobel Prize of 2000 for his work in microeconometric applications in the choice of transport modes. Transport economics has always offered unique opportuni-
ties to apply and develop new concepts, and the scientific challenges remain vast. Typically, transport economics is differentiated into subfields relating to various means of transport. I have worked in most of these fields, on the price elasticity of aviation demand, on the economic impact of high-speed rail systems, on congestion pricing on highways, and even on future applications of pipelines for underground logistical systems. Of all fields, road transportation has typically received the most attention, and I have written many papers on this subject as well.

The concept of ‘consumer surplus’ stems from the 19th century and was developed by a French transport economist who studied the construction of channels.

Transport economics can result in useful applications for practical problems. Can you describe how science and practice interact in your field of expertise?

Scientific insights can reach society in different ways. In the case of transport economics, one very fruitful link with society exists through students who become policymakers after graduation. Through the lessons these alumni have learned at the university, science can contribute to the solution of transport-related problems. Direct transfers of scientific insights to decision-makers can sometimes be more difficult. Transport economists tend to base their solutions on optimal welfare outcomes, which could lead to distribution effects that are too drastic for political success. Technology can sometimes hamper the implementation of scientific breakthroughs as well. An example of this type of limitation was the development of congestion taxes by Pigou in 1920. Pigou created a tax system that charged road travellers for their contribution to travel delays (congestion). Although the system was optimal in theory, the collection of these taxes in practice would easily create more costs than the initial problem itself. Some current technological developments, however, such as ICT, are favourable.

Perhaps a good alternative example of the importance of technological limitations could be found in the recent debate on the choice between the simple cordon charge (tolpoort) or the more sophisticated kilometre charge (kilometerheffing). It appears that technology has dominated this debate, don’t you think?

Indeed, technology has played an important role in these debates, but we should also take into account the aim of the proposed policy instruments. Charge systems can be used to finance infrastructures (actually, infrastructural improvements), which used to be the case for the Zeelandbrug in the Netherlands. But charge systems can also be used as regulatory tools. In that case, the government tries to control road transport in order to solve problems like environmental damage, road safety and congestion. Jan Tinbergen correctly claimed that fundamentally different problems cannot be solved with a single policy instrument. For example, the traditional cordon-charge system is simple in nature and charges people crossing a certain point. Such a system can be used as a financing tool and also as a means to address congestion, but it performs poorly when the goal is to reduce environmental damage or the number of traffic accidents. So far, technological constraints have kept more sophisticated systems from competing with the cordon charge, but recent ICT innovations have expanded the possibilities drastically.

Does the proposed kilometre charge fit the profile of a scientifically optimal solution? Well, consider the fact that commuters are associated with low price elasticities, whereas recreational travellers exhibit high elasticities. Charging systems that cannot distinguish these variations might not be effective in solving a problem like rush-hour congestion. The sophisticated kilometre charge is able to make the distinction along different dimensions—both with respect to travelling time and area, and regarding the pollution factor of a car type. These complex systems,
which involve roadside sensors, on-board blackboxes and satellite communication, might therefore seem too futuristic to be true. Yet, Switzerland introduced a similar system—including all the high-tech trappings—at the beginning of this year for lorry traffic, and so far the system appears to be working satisfactorily. Whereas economic theory discovered the optimal solution long ago, technology has finally made the necessary advances that make the solution feasible in practice.

Whereas economic theory discovered the optimal solution long ago, technology has finally made the necessary advances that make the solution feasible in practice.

According to the ‘Mobility and Welfare Report’ of CPB Netherlands Bureau for Economic Policy Analysis, the Dutch economy would profit from the introduction of a flexible kilometre-charge system. Total automobile mileage is predicted to decline some 14% by 2020, while time losses due to road congestion will decrease by 32%. This would create an estimated annual gain in welfare of 4 to 5 billion guilders. Do you share this positive view?

Our team actually found similar results. Apart from examining these long-term effects, we also studied the impact of a kilometre charge on welfare distribution. The charge itself will have a negative effect on those who will have to pay the bill. However, if these tax revenues can be distributed to road users through lower fixed vehicle taxes, then road users receive some compensation and yet face an incentive to minimise their car mileage. Those who frequently use their cars (like commuters) will face an increase in their net expenses, whereas sporadic drivers will enjoy lower costs. As long as a tight rein is kept on the implementation costs of the charging system, beneficial welfare effects are likely to result.

The introduction of the system may face some obstacles in the short term, but in the long run the kilometre charge is likely to prevail.

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Given all these recent innovations, what do you think the future holds for transport and transport economics?

When considering the future of transport, people tend to dream about futuristic systems of gliding cars and magnetic levitation high-speed trains that shoot through the air. History, indeed, has proven that means of transport are associated with life cycles in which innovations improve efficiency until an alternative is developed that can replace the existing type. Figure 1 (below) clearly illustrates these transport lifecycles over time. This graph suggests that roads appear to have matured by now, and that innovations are on the horizon. I expect that technological innovations will remain important. But I also believe that future gains in transport efficiency will come from organisational improvements rather than technological discoveries alone. In a recent paper I showed that much of the delays that occur in transport are due to poor internal connections. Currently, the different transport networks like trains, metros and roads are not geared to each other and operate as independent entities. I believe that the future lies in network integration, leading to seamless transportation connections.

The introduction of the system may face some obstacles in the short term, but in the long run the kilometre charge is likely to prevail.
instance, a policy maker who is strongly biased against implementing a particular policy may be reluctant to hire a neutral expert, because such an expert will too often recommend implementation of the policy. Hence, when selecting an advisor, a policy maker faces a trade-off between quality of information and the extent of communication. In addition, this paper shows that collecting information gives rise to an externality: policy-driven experts want other policy-driven experts to give advice. The resulting competition can only drive up the price of hiring an expert.

**Time Series Modelling of Daily Tax Revenues**

The production of daily forecasts of tax revenues is an important task of day-to-day cash management at the Dutch Treasury Department. Statistical daily time-series models aim to process information regarding revenues of previous days systematically and efficiently. Dutch central government outflows are usually known at least one day ahead. Therefore, multiple-day-ahead time-series-model forecasts of revenues can also be used to monitor the targets for the budget.

Daily economic time-series data often have properties that make them harder to model and to forecast than monthly or quarterly data (for which numerous standard solutions exist). In addition to the well-known features typical of monthly data—trend, season, trading day and calendar effects—there are two major problems with daily data. First, the number of observations varies per month and per year, which leads to a time series with irregular spacing. Second, account must be taken of daily heteroskedasticity, since the variance often depends on the day of the month. Many aggregate economic transactions have patterns with a clear peak once a month (e.g. salary payments, money circulation, and tax revenues). It is often difficult to stabilise the variance by taking logs: the (persistently changing) seasonal pattern is not simply multiplicative, and neither is the irregular component.

The analysis starts with a periodic regression model with time-varying parameters. The model is then extended with a component for intra-month seasonality, which is specified as a stochastic cubic spline. The stochastic cubic splines we use are smooth functions of the banking-day-of-the-month. These functions vary slowly but randomly over time. State space techniques are used for recursive estimation and evaluation, as they allow for irregular spacing of the time series. State space techniques allow for automatic online updating of estimates of the trend components and seasonal patterns in the tax revenues, as new observations are added over time. The corresponding statistical framework facilitates a systematic online evaluation of the different components of the model.

**Ethnic Entrepreneurship**

Ethnic entrepreneurship has become a popular concept in a modern multi-cultural society for solving inter alia the structural unemployment problems of ethnic groups in cities. The concept has become an important aspect of modern urban development policy.

This case study of ethnic entrepreneurs in Amsterdam shows that there is no clear panacea for successful entrepreneurship. Rather, a variety of critical success (or failure) factors determine the commercial performance of ethnic firms (such as language skills, commercial knowledge, market insight, network contacts, access to venture capital, ICT skills, etc.).
Successful entrepreneurs are able to develop effective strategies for entering mature market segments, rather than focusing exclusively on reaching their own ethnic group. Once established, such entrepreneurs will eventually turn to diversification strategies. The case of Amsterdam confirms these informal economy features for the phenomenon of ethnic entrepreneurship.


Migration and Immigrants

This paper surveys and documents immigration and emigration flows for the Netherlands in the post-war period. Since 1961, annual immigration has surpassed annual emigration. The position of immigrants in the labour market has diverged markedly by their country of origin. Indonesian immigrants have strongly progressed, yet those from the Caribbean occupy a less favourable position. Among the guest workers, those from southern Europe have markedly improved their positions (or returned home after trade liberalisation in the EEC), but those from Turkey and Morocco still occupy an unfavourable position and were hard hit by recession and de-industrialisation. Little is known about the effect of immigration on the labour market position of natives. One study quoted in the paper finds that guest workers are substitutes for low-skilled natives and complements to high-skilled natives, thus depressing the wages of the former and increasing the wages of the latter. The paucity of information on refugees is remarkable.

By Aslan Zorlu and Joop Hartog (UvA). “Migration and Immigrants: The Case of the Netherlands” TI01-042/3.

Corporate Law Enforcement

Perotti, E. and F. Modigliani.

Extending the recent literature on the impact of the legal system on the development of financial markets, this article argues that poorly enforced regulation may explain the relative importance across countries of banking and security markets in financing firms. Securities are most vulnerable to poor enforcement. When minority investors’ rights are poorly protected, firms will find it difficult to raise equity capital, leading to less financing for new risky ventures. More generally, fewer firms will be financed with outside equity, resulting in a low capitalization relative to GNP, and a predominance of internal (unlisted) equity and bank lending over traded securities. A measure of poor protection of minority investors can be found in the market value attributed to control the power to vote in general shareholder meetings. A price measure of this voting right can be extracted in countries in which virtually identical securities from the profile of income rights have differential voting rights. The difference is termed the voting premium. In a subset of countries where the voting premium is very large, around 80%, corporate financing tends to be dominated by bank lending, and equity markets are much smaller. In the other subset, with voting premia below 20/30%, external financing for companies via listed securities is significantly more abundant.


Dealing with irrationality

Making descriptive use of prospect theory to improve the prescriptive use of expected utility

H. Bleichrodt (EUR), J.L. Pinto and P. Wakker (UvA).

Many studies have found that actual human behavior deviates from rationality postulates. Among these findings, positive constructive results are notoriously absent. If the goal is to implement optimal policies, but there is reason to believe that the measurements of utilities are biased (e.g. overly risk averse), then what are the proper ways to proceed and to
requires further discussion.

Some classical paradoxes of utility measurement, where logically equivalent methods find different results--while they should find the same--are resolved by our approach. The different methods are reconciled and is found a consistent way to measure utilities for optimal decisions and policies in risky situations. The paper briefly acknowledges that the ethical dilemma of either accepting unreliable utility measurements "as is" (similar to consumer sovereignty), or changing these measurements as proposed, requires further discussion.


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### The heart of the matter

**Essays on Economic Growth and Imperfect Competition**

Economic growth is at the heart of economic policy. What must a country do to boost productivity and to raise the rate of growth? Much attention has been given to the German 'Wirtschaftswunder' or the miraculous example of Japan. However, these countries turned out to be 'normal' after all--at least in terms of economic performance. The truth is that a blueprint for high productivity and growth is not readily available. Even if such blueprints should be formulated, though, 'second-best economics' provides the reasons for scepticism. Introducing or increasing a 'distortion' in an already distorted economy may prove to be beneficial. For example, a national trade union may indeed be conducive to fast growth and solid macroeconomic performance, or competition in goods markets may actually lower the incentives to invest in innovative products, and progressive taxes may help to boost employment. These examples do not add up to a blueprint, let alone a blueprint in which markets are given unrestricted leeway. Instead, economic policy benefits more from careful analysis of existing distortions and the interaction of these distortions with policy measures.

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**Thesis:** "Essays on Economic Growth and Imperfect Markets" by Paul J.G. Tang. Published in the Tinbergen Institute Research Series # 246.

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### Analyasing customer relationships:

**Linking Relational Constructs and Marketing Instruments to Customer Behaviour.**

Customer relationships, defined as a series of repeat-ed exchanges between a supplier and the customer over time, are garnering increasing attention in both science and practice. This attention is reflected in the enormous investments made in Customer Relationship Management. In this context, an interesting question is how customers' perceptions of the relationship (such as their satisfaction and the feeling of identification with the company (commitment)) affect their behaviour. A related issue is how relationship-marketing instruments such as loyalty programmes influence this behaviour.

The study examines customer retention, or the probability that a customer keeps doing business with the company, buying new products from the same firm, and spreading the information about the product (word-of-mouth). In addition, some aggregate indices of customer behaviour were considered, like the share of a particular customer in the total purchases of a given product, and the ability of the customer to generate profits. The results of a longitudinal study among customers of a Dutch financial service provider reveal some interesting patterns. The impact of customer perceptions on customer behaviour appears to be relatively small. Satisfaction positively affects customer retention and purchases of new products only for those customers with lengthy relationships. Commitment positively affects all types of behaviour. An interesting finding is that those customers who perceive the price of the financial products to be fairer are less willing to buy additional products from the same company; these customers seem to thus generate less profits. A possible explanation is that these customers pay extra attention to prices, and "shop around" to find the most attractive offer in each product category separately. As for the effects of loyalty programmes, they seem to be small, decreasing with the customer's commitment to the company.

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**Thesis:** "Analyzing Customer Relationships. Linking Relational Constructs and Marketing Instruments to Customer Behaviour." by Peter Verhoef. Published the in Tinbergen Institute Research Series # 255.
Discussion papers

Institutions and Decision Processes

01-052/1
Robert A.J. Dur and Otto H. Swank, Erasmus Universiteit Rotterdam, Producing and Manipulating Information: Private Information Providers versus Public Information Providers

01-053/1
Hsiang-Ke Chao, Universiteit van Amsterdam, Milton Friedman and the Emergence of the Permanent Income Hypothesis

01-054/1
Eduardo L. Giménez and Manuel González-Gómez, Universidade de Vigo, Efficient Allocation of Land between Productive Use and Recreational Use – An Application to Galician Case

01-058/1
Ronald Bosman, Frans van Winden, Universiteit van Amsterdam, Anticipated and Experienced Emotions in an Investment Experiment

01-059/1
Peter Rodenburg, Universiteit van Amsterdam, Tracing the Changing Measures of Unemployment in Dutch Unemployment Statistics 1900-1940

01-060/1
David J. Dekker, Erasmus Universiteit Rotterdam, The Price of a Price: On the Crowding out of Social Norms

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01-062/1
Eleco Modderman, Cees Gorter, Jasper Dalhuisen, Peter Nijkamp, Vrije Universiteit Amsterdam, Labour Manoeuvrability and Economic Performance in Township-Village Enterprises: The Case of China

01-063/1
J. Brinkhuis, Erasmus Universiteit Rotterdam, V. Tikhomirov, Moscow State University, On the Duality Theory of Convex Objects

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Addresses
Tinbergen Institute Amsterdam
Keizersgracht 482
1017 EG Amsterdam
The Netherlands

Telephone: +31 (0)20 551 3500
Fax: +31 (0)20 551 3555

Tinbergen Institute Rotterdam
Burg. Oudlaan 50
3062 PA Rotterdam
The Netherlands

Telephone: +31 (0)10 408 8900
Fax: +31 (0)10 408 9031

e-mail: tinbergen@tinbergen.nl
http://www.tinbergen.nl

After serving three years on TI’s Board (with one year as chairman), Professor J.S. Cramer (left) will resign as a member of the Board as of January 1, 2002. We are pleased to introduce Dr. J.J.M. Kremers (right), who will succeed Prof. Cramer.

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Address for correspondence/subscriptions: Tinbergen Institute Rotterdam, Burg. Oudlaan 50, 3062 PA Rotterdam, The Netherlands.
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