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The economy as a complex nonlinear system

Interview with Jean Frijns: 
Management of pension funds in an unstable financial market

InDepth
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Post-reform competition in the derivatives markets
As you might have noticed, TI Magazine has gotten a new look, reflecting Tinbergen Institute’s new corporate house style, which you’ll be seeing a lot more of in coming months. The magazine still features the same great interviews and information about the research going on at Tinbergen Institute, but now with more color and a dynamic new layout. Enjoy!

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Bauke Visser has been appointed as the new General Director of the Tinbergen Institute, starting the 1st of January 2011.

Visser is professor of Economics at the Erasmus School of Economics, with research interests including Organizational Economics and Corporate and Political Governance. He has extensive experience with Tinbergen Institute as member and chair of the educational board, coordinator of the micro sequence, lecturer and research fellow. The Board of Tinbergen Institute is proud to have engaged Visser for the position of general director of TI and wishes him all the best in his new role.

Visser will succeed Herman van Dijk, who is retiring in as director of Tinbergen Institute and professor of Econometrics at the Erasmus University Rotterdam in January 2011. Van Dijk plans to continue working as a mentor to young scientists, and will further focus on his scientific work. Tinbergen Institute is grateful indeed to Herman van Dijk for his commitment to the Institute during the past years.

The IPRC gave Tinbergen Institute excellent marks in its 2010 report on TI’s graduate programme, activities, research endeavors and position among other research institutes. Here are some highlights:

“Overall, the committee was impressed by the way the TI is conducting its activities. These activities are of a high quality. They show a high level of productivity by the researchers and a vitality, visibility and relevance that accord well with the mission of the TI. We found a very collegial atmosphere operating among the Research Fellows. The students were also very satisfied with the teaching program and the research supervision. We judged the graduate programs to be excellent. We were also favorably impressed by the successful joint activities with the recently established DSF. We feel that this development provides a signpost towards further innovation at TI”.

“The TI is now in a position to become a centre of world-class research to rival other leading research groupings in Europe and North America. Success in this endeavor would strongly enhance the position of research and graduate teaching in economics and finance in the Netherlands, in general, and the three departments, in particular”.

The International Peer Review Committee 2010 consisted of the following persons:

Richard Blundell, Chair. Blundell, who holds the David Ricardo Chair of Political Economy at University College London, is Research Director of the Institute for Fiscal Studies, where he is also Director of the ESRC Centre for the Microeconomic Analysis of Public Policy.

Robert Engle, who received the 2003 Nobel Prize for Economics, is currently the Director of the newly created NYU Stern Volatility Institute and is the Co-Founding President of the Society for Financial Econometrics (SoFiE).

Andreu Mas-Colell is Professor of Economics (Catedrático) at the Universitat Pompeu Fabra, Barcelona, and Chairman of the Barcelona Graduate School of Economics.

Torsten Persson is Professor of Economics of the Institute for International Economic Studies in Stockholm.

Tony Venables CBE is Professor of Economics at the University of Oxford, where he also directs the Centre for the Analysis of Resource Rich Economies.
Many of the poorest and middle-income economies of the globe have explored or are discovering huge windfalls of natural reserves. Think, for example, of oil in Nigeria or Malaysia, copper in Zambia, diamonds in Botswana, gas in Russia or oil in Kazakhstan—but also of the oil coming on stream in countries such as Ghana, or the huge reserves that may be under the ground in countries such as Afghanistan, still waiting to be explored. Although some of these countries are showing remarkably impressive economic performance, many are plagued by corruption, civil war and disastrous economic outcomes. Indeed, many argue that natural resources are a curse rather than a blessing because of real exchange rate appreciation, absorption problems and Dutch disease, corruption, civil conflict and the notorious volatility of commodity prices. 1

Clearly, a temporary resource windfall of foreign aid or natural resource revenues poses important policy challenges. Should the revenues be used for government investment in public infrastructure to stimulate economic activity? Should the government use the windfall income to reduce government debt and thereby lower interest rates and boost private sector investment? Should the extra income be used to provide more education, health care and other public goods to improve the quality of life or should it be transferred directly to citizens through tax cuts? Or, should the windfall be used to transform exhaustible resource assets into interest-earning foreign assets by setting up a Sovereign Wealth Fund for future generations? 2

The traditional policy guidelines proffered by the IMF are based on the permanent income hypothesis: borrow in advance of the windfall, pay back and build a sovereign wealth fund, and use the interest on the fund after the windfall to sustain a permanent increase in consumption. But this advice is not relevant, for several reasons.

First, for heavily indebted economies paying a big interest premium on foreign debt, it is optimal to use the windfall to pay off debt, lower interest rates and boost private and public sector capital accumulation rather than building a sovereign wealth fund. 3 In line with the Growth Committee, chaired by the Nobel Laureate Michael Spence, priority must be given to high-return domestic investment to speed up economic development and economic growth in many of the poorest, resource-rich countries on the globe.

Consumption must rise immediately, due to consumption smoothing, particularly given the poverty of the current generation. However, the boost to consumption is less than under the permanent income hypothesis, because of the need to finance infrastructure and debt reduction. This investment has direct benefits and also raises the rate of private investment, putting the economy on a more rapid growth path. This is associated with rising wages, and it is this—rather than rising transfers—that drives the rapid increase in consumption. Emerging oil-rich countries such as Ghana have already set up a Norwegian-style oil fund, but this may conflict with harnessing the impending oil windfall for economic development.

Second, the main problem facing many developing economies is that it is very difficult to satisfy the extra demand resulting from the windfall. Nurses are needed to train nurses, teachers to educate teachers, infrastructure to produce infrastructure, and so forth—which all takes time. Rather than wasting scarce funds on inefficient projects it may be optimal to park some of the windfall abroad until there is sufficient home-grown capital to meet demand. Of course, small, oil-rich countries such as Kuwait are wealthy enough to import all of the capital (both physical and human) from abroad, as is clear to see for anyone who visits Kuwait. But such a strategy is infeasible for a very large oil-rich country like Nigeria, which has to find a

Managing windfall revenue in developing economies

Rick van der Ploeg

Rick van der Ploeg is Professor of Economics at the University of Oxford and is Co-Director of the Centre for the Analysis of Resource Rich Economies (OxCarre). His affiliations also include the University of Amsterdam and Tinbergen Institute.
way to use the windfall to train teachers, nurses, lawyers, and so on, and to build infrastructure – even though meeting the challenge of getting the non-traded sector ready to perform these tasks will take time and effort.

Third, political economy explains why governments that fear being booted out of office over-invest in partisan, illiquid investment projects, leading to investment that may be excessive and of the wrong type. Furthermore, there is a political economy bias against investing in a liquid, non-partisan sovereign wealth fund, as this can be raided by future rivals. President Chavez of Venezuela has engaged in such populist tactics to cling onto power. Other resource-rich countries in sub-Saharan Africa and Latin America have indeed used their windfalls to engage in patronage and satisfy their political clientele.

Fourth, the volatility of commodity prices may force governments not only to provide infrastructure and sovereign wealth in order to share the windfall with future generations, but also to have a liquidity fund. The bird-in-hand rule says that only the interest on the fund should be consumed, but this conservative strategy leads to a very slow build-up of consumption. Better is to calculate how big the size of the optimal precautionary buffer should be. The prime example of this strategy is Norway, which has created a pension fund charged with the task of managing its oil and gas revenues in such a way as to spread this wealth to future generations. Interestingly, even Norway’s prudent strategy is not sufficient to provide enough saving to finance the exploding pension burden. The Norwegian fund also acts as a liquidity fund to cope with volatile oil prices. In contrast, Mexico has actively engaged in hedging future oil revenues against possible falls in the world price of oil.

Fifth, in some cases a country’s government might be prudent and save a large part of their windfall, but their good work will be undone by a profligate private sector that goes on a borrowing frenzy. This is known as the Ricardian curse, which eventually leads to what is known in real estate prices. Many other examples in Latin America are characterized by excessive borrowing by both the private and the public sector when oil prices are high, with the inevitable debt crisis when oil prices collapse.

Finally, if a country’s leadership is very corrupt, so that the windfall does not benefit the people, it may well be better to leave the resources in the ground and stop plundering the wealth of their nations. This may be relevant in failed, highly corrupt resource-rich states such as Afghanistan or Equatorial Guinea, where the majority of the people live below the poverty line.

Notes
1). See the various arguments for this in F. van der Ploeg, Natural resources; curse or blessing, Journal of Economic Literature, to appear.
3). See also P. Collier (2010), The Plundered Planet, Oxford University Press, Oxford.
On January 3, Tinbergen Institute Amsterdam is – together with Duisenberg school of finance – moving to the Symphony building, located at the Zuidas, the financial centre of Amsterdam. The new location has much to recommend it: offering not only workplaces for students, researchers and guests, but also extensive and spacious lecture rooms that can accommodate larger groups of students and researchers.

The Zuidas – the ‘Southern Axis’ – is a major new development zone in Amsterdam. The Symphony building, a multi-functional project located centrally within the Zuidas is within walking distance of the station with rail, metro and bus links. Schiphol airport is six minutes away by train, and downtown Amsterdam is a convenient hop by metro.

Please note that the address of Tinbergen Institute Rotterdam remains unchanged.

Due to the relocation the institute will be closed from December 23, 2010 until January 9, 2011. Our Rotterdam address, telephone and fax number remain unchanged.

We wish you a merry Christmas and a happy new year!

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2011
new address
On January 3, 2011
Tinbergen Institute Amsterdam
will relocate, together with
Duisenberg school of finance,
to their new location
at the Amsterdam Zuidas.
Cars H. Hommes

The economy as a complex nonlinear system
Cars H. Hommes is Professor in Economic Dynamics at the University of Amsterdam and Director of CeNDEF (The Center for Nonlinear Dynamics in Economics and Finance), a multi-disciplinary research group that started in October 1998 by a Pionier grant from the NWO. His current research interests include nonlinear economic dynamics; bounded rationality; and expectation formation and learning.

You are the director of the CeNDEF group. How would you describe the research of that group?
The CeNDEF group has a clear research philosophy. Our main focus is on dynamic models with boundedly rational heterogeneous agents. In these models, a key role is played by nonlinear dynamics, which has been my main interest since the start of my career. My PhD thesis, in fact, was on applications of nonlinear dynamics in economics.

Heterogeneity is a very natural source of nonlinearity, which is why we have done a lot of work on heterogeneous agent models. If you have different agents that change strategies over time, then the switching between strategies will lead to a highly nonlinear dynamic system – even if the strategies themselves are linear.

In the real world people are heterogeneous; they do different things and change their strategies over time. They learn and adapt their behaviour, switch between strategies – and that creates nonlinearities, which is why I think studying nonlinear systems is important for economics.

Did your endeavours lead to interesting results on how “the economy really works” that you could not get with traditional models?
Agent-based modelling in finance has a large literature on models with two different types of traders: fundamentalist traders and technical traders. The switching between these two types of individual strategies and heterogeneous expectations seems to play an important role in determining aggregate market outcomes. My work with William Brock (University of Wisconsin) started on that. In 1997 we published a paper in Econometrica on heterogeneous expectations, and in 1998 we wrote another paper that applied this evolutionary switching framework to financial markets. Those models have been calibrated and estimated on financial data, and have also been tested in laboratory experiments at CeNDEF during the last ten years. The results of those experiments can be described quite well by our theoretical switching models.

Instability in economic systems gets a lot of attention in your work. Does that focus allow you to say something about the economy that traditional models cannot address?
Yes. Take the model with fundamentalists and trend followers. This model has been fitted on S&P 500 stock market index data to see whether switching between these strategies is significant. One of my former PhD students, Sebastiano Manzan, estimated the parameters of this model using 130 yearly data points of the S&P 500, and he found that over time the fraction of fundamentalists and trend followers changes. There are periods when you have a lot of trend followers – the late 90s, for example, when we had the Internet (or dot-com) bubble.

When you have a bubble, it almost always starts with a fundamental change in the market. In the late 90s, this change was driven by the invention of the Internet, a fantastic technology that was expected to create profit opportunities. However, in a model in which agents learn to switch to trend-following behaviour because that strategy has performed well in the last few years, the trend is reinforced – causing a much stronger bubble than would otherwise occur.

What comes out of our research is that trend-following behaviour can be very important, especially when you have positive feedback loops. Say the price of a stock rises. Trend followers will then predict further price rises, which means that they will buy at the current price, causing the price to rise. Trend followers will make profits, as they correctly predicted the price rise. In that case, more agents switch to trend following – so that the price becomes even higher, leading even more agents to switch to optimistic strategies, etc., thereby creating a bubble.

I believe this is an important insight for regulatory policy and also for monetary policy, because in macroeconomics one often finds positive feedback.
Could you give a concrete example of a situation in which heterogeneous agent-based models and traditional models give very different predictions?

That’s a difficult question, because policy based on agent-based modelling is in its infancy. But take the question: “how can we prevent a future financial crisis?” We have written a paper on the perils of financial innovation in a boundedly rational world. The common wisdom in finance is that financial innovation, such as the development of new derivative products, is a good thing because it stabilizes the economy and increases welfare. There are theorems that prove this, but these typically hold only under the (unrealistic) assumption of rational expectations. We studied financial innovation in a heterogeneous expectations model, and found out that if agents are boundedly rational – in the sense that they switch between fundamentalist and trend-following strategies based upon their recent performance – then financial innovation is a “bad” thing: it destabilizes the economy and decreases average welfare.

There is a simple intuition for this result. When there are more financial products, agents take bigger positions because they think they can hedge away the risks. At the start of a trend, trend followers take bigger positions so that their profits will be bigger. In a model with reinforcement learning in which agents switch to strategies that are performing well, these higher profits increase the share of trend followers – which further destabilizes the system. In the end, this bursts the bubble and decreases average welfare. So here you have a very simple example where the policy implications are completely different in models with rational- and boundedly rational agents.

Of course, in reality it is very difficult to find out whether the stabilizing or the destabilizing effect dominates, because it is also clear that financial instruments have welfare-improving properties due to better spreading of risk. I think it is important to not only think about these issues in highly stylized models, but also to try and build a realistic agent-based model that includes all of the complicated financial instruments we see in real markets – and to see what happens in agent-based simulations.

“In the real world people are heterogeneous; they do different things and change their strategies over time. They learn and adapt their behaviour, switch between strategies – and that creates nonlinearities.”
Do you think these insights will help to improve policies in the future? Will policymakers listen?

Yes, I believe so. To illustrate the interest: the NWO (Dutch Organization for Scientific Research) has a programme on complexity for which they have set aside 7 million euros, distributed over 14 projects. CeNDEF was lucky to get one of these complexity grants in cooperation with the DNB (Dutch Central Bank). The DNB is very interested in complex systems because they think complex systems can help to explain the financial crisis, and may even help to prevent future crises. So practitioners and policymakers are definitely interested.

A few months ago I was at the FED in Washington at a conference on learning in macro- and monetary models, and I was invited to give a lecture on complex systems and heterogeneous expectations. There were quite a few mainstream people in the audience, and there was a panel discussion on policy models. A lot of FED and IMF models are based on rational agent theory, and people at this conference were emphasizing the importance of including non-rational behaviour in their models.

In practice, only rational agent models are used to make predictions. Now, suppose that the assumption of rationality is wrong. This would mean that the policymaker has a big problem. If I were a policymaker, I would certainly not bet all my money on one type of model. I would let the policy recommendations be made by different types of models, and see whether you get important differences or not – and then use that as an input for the policy decisions.

Laboratory experiments show us that individual and aggregate behaviour is not at all like rational behaviour, or what rational expectations models would predict. As a policymaker I would be worried about that. You can say “these experiments are highly stylized and very simple, not like the real world”. But if rational expectations does not work in these simple environments, why would it work in very complicated environments like those modelled by the IMF?

If heterogeneous expectations, bounded rationality and nonlinearities are so important, why have these factors been ignored for so long in mainstream macro models?

I’m not sure that I’m the right person to answer that question; you should really ask some of my colleagues. Personally, I can think of several reasons. It’s a matter of tradition, but also of training. If you do not learn about it in your Bachelor or Masters programme, you simply will not know about it. I was brought up in nonlinear dynamics, studying mathematics in Groningen. If you studied mathematics or physics you would automatically come across nonlinear dynamics in seminars or courses – but in economics that is still not the case. But it is changing. Here at the University of Amsterdam, in both the econometrics Masters programme and the TI programme you can take some courses in nonlinear dynamics and bounded rationality.

It’s on offer, but not obligatory. You can avoid it easily, and many people who do macroeconomic modelling never look beyond the mainstream.

In any MPhil programme, a lot of the “indoctrination” happens in the first year. So when there is a lot of mainstream modelling in the first year with very good and enthusiastic lecturers, then for students it is entirely natural to take field courses in that area and write a thesis with an advisor they already know from the first year. I think that’s one of the reasons that relatively few students take courses in nonlinear dynamics or bounded rationality.

Another reason is that nonlinear global dynamics is difficult; it’s easier to work with a linear approximation. A good thing about the TI programme is that for each research group there’s a lecture once a year that introduces the research group to first-year TI students. I have done it a couple of times, and have observed that, for most students, nonlinear dynamics is like magic. When you think about dynamic processes, it is natural to think about convergence to a constant steady state. For some, it may also be natural to think of oscillations and periodical motion. The possibility of irregular, chaotic fluctuations, however, is beyond their imagination – and no wonder, because the discovery of chaos has been viewed as one of the scientific revolutions of the 20th century.

So, it be fair to say then that you are not entirely happy with the TI programme?

Would you like to see a nonlinear dynamics course in the first year?

Well I don’t like to complain, but in my view there is too much mainstream economics in the first year. I think it should be more heterogeneous. On a couple of occasions I have suggested to the directors that they might want to add some nonlinear dynamics in the first year. There is a course on dynamic optimization – but why not spend two weeks on methods of nonlinear dynamics, together with computer simulations? Or, even better, replace one of the five (!) (mainstream) micro- or macro courses by a basic course on complex systems in economics. It is important that students are confronted with complexity and nonlinear dynamics at an early stage – in order to show them that not everything converges to a steady state. Unfortunately, my efforts to convince the people at TI of that view have not yet been successful.

Would you go so far as to say that nonlinear dynamics doesn’t penetrate the mainstream because PhD programmes, by and large, ignore this area – or would you also cite other reasons?

Academia is extremely conservative. Even the current financial and economic crisis will not lead to big changes, I think, and rational models will continue to dominate in the top-five journals.

I was lucky that my first paper with William Brock got published in *Econometrica* – and that has been part of the reason why our work on heterogeneous expectations has been quite influential. At that time I was rather young, and thought it would be possible to convince mainstream economists of the importance of this type of work. But, regrettably, things did not change that much. Even nowadays, I hear too often the same negative comments from (mainstream) referees that I heard already 15 years ago.

What kind of comments?

For example, that nonlinear dynamics is not important, because a linear approximation is sufficient. Or that bounded rationality models are too ad hoc, that there are too many degrees of freedom. Or, that more realistic, agent-based, models are not analytically tractable – and that the results depend on simulations. There is scepticism about what you can learn from simulations. Too
many economists still prefer a more abstract model for which you can find analytical results – even though the assumptions of these abstract models are also very abstract, and might not be very realistic.

So, what can we learn from these simulations?
When you carry out simulations, you have to proceed carefully and systematically. I think that the work we do here at CeNDEF manages to find a good equilibrium between simple stylized models, which are still partly tractable, and agent-based simulations. For instance, one can often still do a local stability analysis of steady states and compute the first bifurcation (i.e. the onset of instability). This information gives you some economic intuition about the model, which can be supplemented by systematic simulations. From these simulations, for example, you can get statistics that could provide information about the regularities of the model.

What about the other critique, on the ad hoc assumptions about the agents?
The critique that a model is ad hoc is an easy critique that is too often used to reject papers. With every model there is an issue of how realistic the assumptions are and how ad hoc they are. In agent-based modelling, a lot of people calibrate their model on real data. They compare the outcomes of their model with statistical regularities, the stylized facts, of real data. That is also what we do here at CeNDEF. We also run experiments and compare the assumptions in our model to the observed behaviour in the lab. These things bring discipline to our models. So we justify our assumptions. Is a realistic simulation model not worth more than an abstract analytically tractable model with unrealistic assumptions? In my view, (at least) 10-20% of the articles published in the mainstream journals should be agent-based bounded rationality models. Of course, the authors should have a reasonable story behind their model, and validate their assumptions by empirical data and/or experiments. But I am optimistic that, wherever economics is going in the short run, in the end it will become a behavioural science once again.

Post-reform competition in the derivatives markets

The Dodd-Frank Act, which is aimed primarily at improving financial stability, might also lead to significantly more competition in the over-the-counter derivatives market. Much depends on regulatory interpretations of the Act and on rulemaking outside the US, particularly in London.
Until now, competition in the over-the-counter derivatives market is limited by the fact that a small number of dealers intermediate the lion’s share of trade. (The top five US dealers hold about 95% of the derivatives held by all US bank holding companies.) A hedge fund would not negotiate a trade directly with an insurance company, for example, because each would rarely be aware that the other is interested in making the trade. Instead, both would call a dealer, asking for a bid and an offer. A dealer takes each trade on its own account, profiting on average from the bid-offer spread and absorbing the risk of the trade until laying it off with another customer or dealer. Because most trades already go through the biggest dealers, customers are more likely to call these dealers than to search for another suitable counterparty. Competition arises from the ability of one dealer to offer better terms than another, but is limited by the small number of major dealers. It has also been difficult to get dealers to compete actively with each other for an over-the-counter trade because most of these trades are negotiated bilaterally.

A dealer’s bid and offer will not stand still while a customer goes in search of better terms. In contrast to an over-the-counter market, a buy order sent to an active exchange is simultaneously exposed to many competing sell orders.

The Dodd-Frank Act forces derivatives to be traded on exchanges or on “swap execution facilities” that offer some amount of exchange-like competition for trades. An example of a swap execution facility is a webpage on which market participants can post their own bids and offers. The Securities and Exchange Commission (SEC) and the Commodity Futures Trading Commission (CFTC) have some latitude in deciding what constitutes an acceptable swap execution facility.

“The Dodd-Frank Act includes some hefty exemptions... and it’s not yet clear how much trading will inappropriately escape competition because of them.”

The Act does, however, include some hefty exemptions. Trades between dealers and “end users” (their non-financial customers) may continue to be negotiated privately. Trades in those types of derivatives for which there is no exchange- or swap-execution facility are also exempted, with the likely intent of permitting some useful financial innovation and customization of derivatives contracts. It is not yet clear how much trading will inappropriately escape competition because of these exemptions.

Transactions reporting will give market participants more information about recent trade prices, thus putting them in a better bargaining position at the time of a trade. Transactions reports will also allow the customers of a dealer to monitor how closely the prices of their past trades match those negotiated elsewhere in the market, providing some incentive for their dealer to make bids and offers that are close to prevailing prices.

Dealers have made the point that real-time price transparency could reduce market liquidity. A dealer would be loath to bid or offer for a large position near the prevailing price if both the price and quantity will be publicly revealed before the dealer has had a chance to lay off the position in subsequent trades. Thus, going forward, dealers may offer poorer terms for large trades unless the new rules of the CFTC and SEC permit the sizes of large trades to remain unreported for a reasonable amount of time.

Overall, the SEC and the CFTC have a significant task ahead of them in deciding how to interpret the Dodd-Frank Act with new rules. It will then remain to be seen whether these new US rules will cause derivatives trading to migrate to other jurisdictions.
Jean Frijns

Management of pension funds in an unstable financial market

Jean Frijns is full professor of Investment Theory at VU University Amsterdam and holds various top managerial positions. Earlier in his career, Frijns worked at CPB Netherlands Bureau for Economic Policy Analysis and later was Chief Investment Officer at ABP (the pension fund for employers and employees in service of the Dutch government and the educational sector).

By Marloes Lammers

You have worked in a number of research- and policy-oriented organizations. Could you briefly describe your career? Could you also elaborate on what your main motivation was to move from doing research to pursuing a more policy-oriented career?

My career started at the econometrics department of Tilburg University. After my graduation in 1971 I joined the faculty in Tilburg as an assistant professor with a heavy teaching load; in those days you were supposed to get your PhD within a timeframe of ten years. In 1979 I got my PhD and decided to leave the university for CPB. The main motivation was that I found the academic research at the time too narrow. Working at CPB was a great experience: they have a very practical way to approach relevant economic problems. CPB was, however, narrowly focused on the real economy and not connected enough, for my interests, with the financial world. In 1987 I was asked to set up an investment policy unit at ABP, a large Dutch pension fund. Soon I switched to more managerial positions; in 1993 I was appointed Chief Investment Officer of ABP. In 2005 I retired from ABP; since then I’ve built up a portfolio of part-time advisory and supervisory jobs.

How did you experience the stress of undertaking huge investments during your period at ABP? You must have encountered situations of substantial gains and losses. How does a person deal with such cases?

At ABP we followed a highly structured approach to investments, building on the insights of academic research. Financial markets were assumed to be highly efficient, volatile over short horizons, but stable in the long term. The emphasis was therefore on...
strategic asset allocation, and on convincing the board and (given the dominant position of ABP within the Dutch financial sector) also the politicians that we should get out of Dutch government bonds and build up a widely diversified portfolio of global assets. That took a lot of energy but was not stressful. The real stress came with the financial markets crisis of 2002/2003. The ICT bubble taught us that the idea of efficient markets was naive; there is no way that you could rationalize the ridiculous valuations of ICT stocks at that time (although many did, including well-known professors). Personally, I find it frustrating that, while I had already become convinced around the year 2000 that ICT stocks were grotesquely overvalued, I failed to see the potential severity of the spillover effects of the bursting of such a bubble. So we didn’t de-risk at ABP, and were badly hurt in the subsequent crisis. From an intellectual perspective that was frustrating, but on top of that you had to cope with the emotions and anger of the fund’s participants. Not an enjoyable experience, to say the least.

In hindsight, the ICT crisis of 2002 could be seen as a mere overture to the banking crisis of 2007/2008. Also in this case the signs were written on the wall, but we didn’t want to see them – or if we did see them, we underestimated the severity of a banking crisis. Once more, pension funds were caught largely unprepared by this crisis.
In terms of making forecasts and formulating policy advice for pension systems, what is your stance regarding the use of models vs. the use of expert opinion?

Models are very useful; there’s nothing more practical than a good theory and model. This is certainly true for CPB, which has a longstanding tradition in model-building and using models for policy advice. But at ABP we also benefited greatly from the financial models developed in the academic world (mostly in the US). Models are a great way to develop and diffuse knowledge. The use of models also is a disciplining mechanism in complex organizations.

In your experience, what kind of investment decisions perform better in financial markets: decisions based on expert opinions or those driven by models?

It’s not an “either/or”. Both expert opinions and models suffer from tunnel vision. Their view of the world is shaped by recent history, which implies that, particularly in times of rapid change or financial crises, there’s a potential lack of relevance. Moreover, also models reflect the limitations of the human mind, and are subject to the biases we know from behavioral finance. Most models in finance implicitly assume some kind of stability and equilibrium. Their empirical validation is often too narrow (based on short time periods, and so forth). Financial markets are, however, inherently unstable.

Do you believe that there is some kind of a natural sequence in the crises we are facing now (for example, starting from the financial crisis of banks, moving to the deficit crises of governments, leading to a pension crisis)? In other words: is the current pension crisis the natural consequence of the financial crisis?

Absolutely, we are still reeling from a major banking crisis, which will have a profound and long-lasting impact (including the de-leveraging of the banking sector, a depressed housing sector, soaring government debts, to name a few). The policy reaction by the central banks, together with the de-leveraging process, have led to extremely low interest rates, which is very bad for pension funds.

Did you consider the banking crisis in 2007 to be a predictor of the current crisis, or was this crisis generally believed to be a temporary setback?

Before 2007, there were two views on the impact of the bursting of an asset price bubble. One was the dominant US view, advocated by the FED and supported by and large by the academic community. This view maintained that you cannot predict prices, let alone crises. Crises will incidentally occur, but adequate responses by the monetary authority should render such crises temporary and manageable. This paradigm was gladly accepted by the financial world and was coined the “Greenspan put”. The other view, advocated by BIS researchers like Borio, but before him by people like Minsky or Kindleberger, was more pessimistic. This view called for a distinction to be made between a narrow market crisis and a banking crisis. A market crisis can be temporary: that is, after a shock people resume trading and prices recover. All you have to do is make sure that markets get enough liquidity. Banking crises, however, are destructive and not easy to fix; their effects are long-lasting. Although there was broad empirical support for this second view, the first view has dominated. After all, straightforward empirical research is not highly regarded in academic circles. We now know better – but how long will that last?
Maurice Allais passed away on 9 October, 2010, but his name will remain associated with an effect in physics and a paradox in economics. Discussing whether the “Allais effect” is a valid argument against Einstein’s theory is beyond our competence. But as economists, we have been deeply influenced by the need Allais felt to confront economic theories with experimental tests. This contribution explains how experimental research has helped to improve economic theory. Our focus is on the three domains of individual decision-making that coincide most closely with our own research pursuits: decision under risk, decision under ambiguity, and choice over time.

What do Einstein’s theory of relativity and von Neumann and Morgenstern’s expected utility theory have in common? The answer is Maurice Allais, a Nobel laureate in economics who conducted experiments to falsify both.
Decision under risk

Suppose you have been diagnosed with a particular illness and have to choose between two treatment options, depicted in Figure 1. Option 1 is the certainty of living with major health problems for the rest of your life. This means that you have difficulty walking, are unable to participate in most leisure activities, and have moderate pain. Option 2 is to undergo a treatment that can either succeed, in which case you live in good health for the rest of your life, or fail, in which case you die within a week. The question you need to answer is essentially the following: Which risk of death are you willing to accept that will prompt you to opt for the treatment? 0%, 5%, 10%, 20%, or even 50%?

Figure 1: Treatment choice

Real data suggest that this maximum risk of death is about 10%. If the risk of death is less than 10%, we prefer the treatment, if it exceeds 10% we prefer to live with major health problems. Following expected utility (the theory that is traditionally used in economics to analyze risky decisions) would lead us to conclude that our value of major health problems is 90% of the value of good health. So, major health problems are not very serious. Their value is almost equal to good health. If we have them, we’re quite all right, and policymakers concerned with healthcare shouldn’t worry too much about us.

The above-mentioned method for measuring the value of health is referred to as the “standard gamble”. It is widely used in health economics. But is it right? Can we deduce from the conclusion drawn above that the value of major health problems is really as much as 90% of the value of good health? Thanks to the pioneering work of Maurice Allais, we know that this is not so. Major health problems are serious, and their treatment will benefit us a great deal. Nevertheless, we still are not willing to run a large risk of death. The fault in the reasoning behind the standard gamble method lies with the conclusion that a small risk of death translates into a large value of major health problems. In other words, expected utility is wrong. It overestimates the value of life with major health problems. Consequently, cost-benefit analyses of healthcare will underestimate the burden imposed by major health problems, and too little will consequently be spent on their treatment.

The problem with expected utility is that people do not evaluate probabilities linearly, but instead weigh them. Suppose we ask you how much you are willing to pay to reduce the risk of cancer, from 1% to zero. Now, is that the same amount that you are willing to pay to reduce the risk from 5% to 4%? Expected utility says ‘yes’, but it appears that the two reductions are not the same. It’s a different choice. Most people pay more for the former than for the latter. We find completely eliminating the risk very comforting. We want to feel safe. Probability weighting implies that the standard gamble overestimates the value of health (Bleichrodt, Pinto and Wakker 2001, Bleichrodt et al. 2007). It thus underlines the fact that our health problems are serious and that their value is much less than 90% of the value of good health. Having established this, we need to

Aurélien Baillon (left on photo) is Associate Professor of Behavioral Economics at Erasmus University Rotterdam; Han Bleichrodt (right on photo) is Professor of Behavioral Economics at Erasmus University Rotterdam; and Kirsten Rohde is Associate Professor of Behavioral Economics at Erasmus University Rotterdam.

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find out exactly how wrong expected utility is. Empirical estimates suggest that the overestimation is substantial. In the question posed above, using expected utility, we concluded that the value of major health problems was 90% of the value of good health. Adjusting for the empirically observed degree of probability weighting (Bleichrodt and Pinto 2000), this value is actually only 70% of the value of good health – much lower than 90%, and much more realistic.

**Decision under ambiguity**

Eight years after Allais’ famous paper criticizing expected utility as a model of decision making under risk, Ellsberg proposed a comparable thought experiment to show the limitations of expected utility for decision under uncertainty, where probabilities are not objectively given but are subjectively determined. Imagine an urn containing 90 balls. You know that 30 balls are red, the others being yellow or black in an unknown proportion. You can choose a colour (red, yellow or black), randomly draw a ball, and win, say, €1,000 if the colour of the ball is the one you chose. Which colour would you choose?

If you answered “red”, we have good news and bad news for you. The good news is that you are like most people. The bad news is that you have just violated expected utility. Indeed, under expected utility, your answer means that your subjective probability of drawing a yellow ball is less than 1/3. The same holds for the probability of drawing a black ball. As a consequence, the sum of your probabilities for red, yellow, and black, is less than 1, which cannot be. Drawing a yellow ball and drawing a black ball are ambiguous events: we don’t know their probabilities.

Systematically choosing red corresponds with ambiguity aversion.

Many models have been developed to account for ambiguity aversion. One of the most widely-used is a variant of expected utility. Suppose you chose “red”, because you were not sure about the probabilities of yellow and black. For instance, you thought those probabilities could be somewhere between 1/6 and 1/2, and considered a choice for red to be safer after focusing on the lower bound (1/6).

Such a decision process can be captured by maxmin expected utility: you evaluate each option by its minimum expected utility (worst-case scenario) and choose the option that maximizes this minimum.

Advocates of expected utility might feel relieved: it seems that expected utility can still be used, after all, albeit with minor modification.

Unfortunately, this rescue strategy does not work. Elaborating on two paradoxes introduced by Machina (2009), Baillon, L’Haridon and Placido (2010) showed that all popular models for ambiguity aversion, including maxmin expected utility, can also be falsified.

Imagine a new urn, now with 100 balls. Fifty are marked with a ‘1’ or a ‘2’, and the other 50 with a ‘3’ or a ‘4’. We randomly draw a ball from this urn, and your payment depends on the number on the ball. Table 1 presents two decision problems, with two options each. For instance, option B in problem 1 means that you can get €1,000 if the ball is marked with a ‘1’ or a ‘2’ (thus, with probability 1/2), and €2,000 if the ball is marked with a ‘3’.

**Table 1: One of Machina’s paradoxes**

<table>
<thead>
<tr>
<th>Number on the ball</th>
<th>Problem 1: Which option do you prefer?</th>
<th>Problem 2: Which option do you prefer?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Option A</td>
<td>€1,000</td>
</tr>
<tr>
<td></td>
<td>Option B</td>
<td>€1,000</td>
</tr>
<tr>
<td></td>
<td>Option C</td>
<td>€0</td>
</tr>
<tr>
<td></td>
<td>Option D</td>
<td>€0</td>
</tr>
</tbody>
</table>

“Decisions about the future are influenced by our assessment of future risks and by our degree of impatience.”
“The problem with expected utility is that people do not evaluate probabilities linearly, but instead weigh them.”

choice pattern by considering the worst-case scenarios. If you chose B and C, you violated maximin expected utility.

Since studying urns and balls sheds light on merely one aspect of everyday decision-making, we use other sources of ambiguity in our studies (weather, stock indexes) to help us understand people’s reactions to unknown risks. In the past few years, decisions made by both the government and individual citizens have highlighted the tendency to react strongly (dare we suggest, overreact?) when new threats appear. Examples include strategies to combat swine flu (for which far too many vaccines were purchased, and which governments are now desperately trying to sell), and to neutralize terrorist threats (which have led to draconian security measures like body scans at airports). Our models provide insight into such (over) reactions and help to improve government policy.

Choice over time

Decisions about the future are influenced by our assessment of future risks and by our degree of impatience. Suppose you are asked to choose between one chocolate bar today and two chocolate bars tomorrow. Many people are impatient and choose the chocolate bar today. But what if instead you had to choose between one chocolate bar in 50 days and two chocolate bars in 51 days? Most people then choose the two chocolate bars in 51 days. What is the difference between 50 and 51 days after all? Well, this difference is the same as the difference between today and tomorrow: one day. Nevertheless, the former difference feels much smaller than the latter – just like the reduction in the risk of cancer from 5% to 4% felt smaller than the reduction from 1% to 0%. In Rohde (2010) and Attema, Bleichrodt, Rohde and Wakker (2010) we developed and implemented a method to measure such decreasing sensitivity to delay. Assigning less weight to delays in the far future than to more immediate delays can lead to inconsistencies. This decreasing sensitivity to delay is at the heart of our tendency to keep postponing unpleasant tasks. We often have many good intentions and plans, but tend not to carry them out. Smokers intending to quit soon end up smoking their entire lives. Similarly, many people intending to save for their pension end up saving too little.

Standard economics assumes that people discount the future at a constant rate, implying constant sensitivity to delay; a delay is always perceived to be equally inconvenient, regardless of whether it occurs in the near or the far future. As noted above, this does not accurately describe people’s preferences. In Attema, Bleichrodt, Rohde and Wakker (2010) we found that the alternatives that are widely-used these days (“hyperbolic discounting” models) are too limited. In Bleichrodt, Rohde and Wakker (2009) we introduced new discounting models that can capture any degree of sensitivity to delay but that remain tractable for economic analysis. These models are based on insights from decision under risk, showing the similarities between different domains of individual decision-making. In our research we exploit these similarities, keeping in mind the wise lessons of Maurice Allais on the fruitfulness of combining insights from different areas of research.

References


Betty (H.T.) Wu, Yonsei University, Seoul, South Korea


Being invited to write this issue of “Letters from Alumni” came as quite a surprise to me. After all, it’s only been three months since my PhD defence in July. After some thought, I decided to take this opportunity to briefly describe my personal experiences during my last year at TI, preparing for the job market in Finance and the subsequent/concurrent thesis defence. While PhD students at TI learn arduously how to do sound research, they learn relatively little about how to secure a (good) job. I hope that my “journey” described here will encourage and help TI students as they prepare for the final stage of their PhD study.

Normally, job market guidelines would suggest starting to prepare in August, about one year before the new employment. In my case, however, I was not seriously considering this issue until last October. After discussions with my advisors, I decided to enter the job market because of no other better alternatives, given that my PhD would end in the following August. Of course, the necessary condition is to have a (fairly decent) job market paper at hand (better, now that I consider it, to have two more in the works, so that you can expect to graduate in time). So, I chose one of my papers and finished it as soon as possible. In the meantime, I collected information on all open (academic) positions from various sources (mostly online websites such as SSRN, AFA, and ECON JOB MARKET), and managed these in a spreadsheet (very handy, especially when it comes to sending out all your application materials). My idea was to apply to as many as possible and to decide later, based on the results. The application deadlines are clustered in November, and usually end in mid-December.

After the deadlines, there is a period of silence, when one anxiously waits for the positive results: the 30-minute interview opportunities. Other than on-campus interviews, most recruiters schedule job interviews at the annual meeting of some major conferences, such as AEA, AFA and FMA. In other words, these interviews are held “in parallel” with the main conference programmes. During a typical interview, you would be invited to a hotel suite/room for a talk about your paper(s) with the recruiting representatives (two to six people). Interviews might also take place in other (public) places (such as a common area with a group of recruiters). My advice: Get these people interested in what you do (no nitty-gritty parts, unless asked), and keep yourself engaged all the time. You might want to practice a few times with your friends or conduct mock interviews with your faculty members beforehand. It really helps.

Then, prepare to sit back and “enjoy” another period of silence, waiting for the so-called “fly-out” opportunities. These typically involve a campus visit in which you present your job market paper during a 60- to 90-minute seminar. This might be accompanied by a formal interview with a panel of their faculty members. They might also arrange private talks with faculty members, show you around the campus, and take you to lunch/dinner. It is a good chance for you to get to know people and envision your (daily) life there, which can be important in your decision making later. If an offer is made, a deadline is set for you to reply. Regardless of the decision, you should respond. Once you’ve accepted the offer, you soon have the official contract to sign. In my case, however, I did not sign my contract at Yonsei University until July.

Did I miss anything here? Yes, how about the thesis? As a matter of fact, you could do these two things simultaneously, if possible. You should know that it takes quite a while to book (and finalize) a defence date, at least five months from start to end. I initiated the whole procedure in late February. I really had time pressure because my contract was contingent on having a PhD degree before the employment commenced (common in Asian schools). To summarize, the job market is a rather long and nerve-racking
Welfare effects of distortionary fringe benefits taxation: The case of employer-provided cars

What are the welfare effects of the current company-car tax regime in the Netherlands? The answer to this question is relevant because many employees in Europe receive company cars as fringe benefits induced by taxation. While most governments acknowledge the problems of traffic congestion due to additional travel associated with company-car taxation, few recognise the problem of overconsumption of cars (in terms of expenditure and ownership). When individuals are provided with a company car, income taxes on the costs of the car are reduced, so that expenditure on such a car may exceed what individuals otherwise would have spent on this car. For example, one consequence is that company cars tend to have bigger engines than private cars. Because most company cars are not (or are not routinely) used for business purposes, and are operated only for private usage (ostensibly to and from the workplace), the company-car tax is set inefficiently low, which results in both a distortion of the car consumption choice and encouragement of more travel, implying a welfare loss. The main finding of the current study is that taxation of company cars in the Netherlands is set too low, generating a welfare loss ranging from €600 to €780 per year per company car. The welfare loss is mainly due to a...
Information, bilateral negotiations and worker recruitment

We show that when firms hire new personnel, they often forego the transparency of the centralized labor market and use referrals by other employers in their social networks. Using laboratory experiments, we demonstrate that this tendency benefits both the hiring firms and the workers who are hired. The idea that bypassing the market is beneficial in this way goes against the intuition of most mainstream economists. A firm can hire along two channels. The first involves employment agencies or advertisements, where multiple firms announce their vacancies and many workers offer their services. The law of supply and demand then determines matches and wages. In practice, many firms do not hire workers in this way. Instead, they ask other employers for information about suitable workers. One of the reasons is related to the type of job. For many jobs, it is difficult to monitor precisely how well an employee is doing. The employer has to trust that the job is being done in the way it is supposed to be. This is where the social network can be useful: other employers can share their experience regarding the trustworthiness of a job candidate. Such information is typically shared in employers’ social networks. A worker has discretion in the effort she exerts after a contract has been established. An untrustworthy worker will accept a high wage but exert low effort. Approximately 30% of the job matches occurred outside of the market. Workers hired in this way earn higher wages, are more trustworthy and generate higher earnings for the firm.

Arthur Schram (UvA), Jordi Brandts (Barcelona GSE), and Klara Gérzhaní (UvA), forthcoming, Information, bilateral negotiations and worker recruitment, European Economic Review.

A simple correction to remove the bias of the Gini coefficient due to grouping

How unequally are incomes distributed? Does income inequality differ between regions? Is the redistributive effect of taxes evolving over time? These and related questions are of vital importance for tax and social policy, and the Gini index is applied most commonly in pursuit of the answers. A drawback of the Gini is its downward bias if applied to data that is grouped by categories or into ranges. Such grouping commonly arises with income or tax statistics that are grouped into a limited number of categories for reasons of confidentiality, or simply because information on the income distribution is available only at an aggregated level. This paper proposes a new method to remove this downward bias. In contrast to the existing literature, it is very simple, since it only requires information on the number of income groups.

The method developed in the paper derives from treating grouping as a form of measurement error. As it only requires information on the number of income groups, it has unrivalled advantages in case the underlying average incomes or income ranges from which the Gini is estimated are unavailable. For example, some of the leading databases on income inequality only provide estimated Gini coefficients, and do not provide information on the underlying income distribution. Inevitably, the sole reliance on the number of income groups also means that the performance of the correction method in the paper depends on the shape of the income distribution. Nevertheless, Monte Carlo evidence and an empirical illustration on European and US data show that the method reduces the underestimation of the Gini considerably.
risk-free rate), on the one hand, (using a bond rate as the risk-free rate), on the other hand. Second, there is substantial variation over time. The analysis in our study revealed evidence of a clear downward trend in the post-war period. Third, significant differences in equity premiums were found between the United States, Canada, the Secondary Emerging Countries and the Asian Tigers. The emerging countries have a larger equity premium than the United States, whereas Canada has a lower equity premium. Finally, the study examined the deeper underlying determinants of the equity premium. The equity premium tends to be higher during periods of, and in countries with, larger economic volatility. There is also a clear negative effect of the interest rate, indicating that the return on equity does not vary one-for-one with changes in the interest rate. This also implies that the return on equity cannot simply be determined by adding a constant equity risk premium to a time-varying short- or long-term interest rate.

This study shows how meta-analysis can explain a substantial part of the heterogeneity of the equity premium found in the literature. The first source of heterogeneity is the applied methodology. Variation in the equity premium is the result of calculating equity premiums ex-post or ex-ante, averaging returns arithmetically or geometrically, and using T-bills or bonds as the risk-free rate. This variation can easily add up to 3.5 percentage points between the extremes of an ex-ante geometrically determined equity premium (using a bond rate as the risk-free rate), on the one hand, and an ex-post arithmetically determined equity premium (using a T-bill rate as the risk-free rate), on the other hand. Second, there is substantial variation over time. The analysis in our study revealed evidence of a clear downward trend in the post-war period. Third, significant differences in equity premiums were found between the United States, Canada, the Secondary Emerging Countries and the Asian Tigers. The emerging countries have a larger equity premium than the United States, whereas Canada has a lower equity premium. Finally, the study examined the deeper underlying determinants of the equity premium. The equity premium tends to be higher during periods of, and in countries with, larger economic volatility. There is also a clear negative effect of the interest rate, indicating that the return on equity does not vary one-for-one with changes in the interest rate. This also implies that the return on equity cannot simply be determined by adding a constant equity risk premium to a time-varying short- or long-term interest rate.

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Tom Van Ourti (EUR) and Philip Clarke (University of Sydney), forthcoming. A simple correction to remove the bias of the Gini coefficient due to grouping, Review of Economics and Statistics.

Discussion papers

A meta-analysis of the equity premium

The equity premium is a key parameter in asset allocation policies. It measures the excess return above the risk-free rate, and as such it can be seen as the price for risk. There has been a lively debate in both the theoretical and the empirical literature on the measurement, size and sources of variation in the equity premium. Because of the uncertainty about the right method and model, meta-analysis is helpful for surveying this literature in a structured manner and enhancing our understanding of the sources of variation in estimated equity premiums.

This study shows how meta-analysis can explain a substantial part of the heterogeneity of the equity premium found in the literature. The first source of heterogeneity is the applied methodology. Variation in the equity premium is the result of calculating equity premiums ex-post or ex-ante, averaging returns arithmetically or geometrically, and using T-bills or bonds as the risk-free rate. This variation can easily add up to 3.5 percentage points between the extremes of an ex-ante geometrically determined equity premium (using a bond rate as the risk-free rate), on the one hand, and an ex-post arithmetically determined equity premium (using a T-bill rate as the risk-free rate), on the other hand. Second, there is substantial variation over time. The analysis in our study revealed evidence of a clear downward trend in the post-war period. Third, significant differences in equity premiums were found between the United States, Canada, the Secondary Emerging Countries and the Asian Tigers. The emerging countries have a larger equity premium than the United States, whereas Canada has a lower equity premium. Finally, the study examined the deeper underlying determinants of the equity premium. The equity premium tends to be higher during periods of, and in countries with, larger economic volatility. There is also a clear negative effect of the interest rate, indicating that the return on equity does not vary one-for-one with changes in the interest rate. This also implies that the return on equity cannot simply be determined by adding a constant equity risk premium to a time-varying short- or long-term interest rate.

By Casper van Ewijk (CPB and UvA), Henri L.F. de Groot (VU and CPB), Coos Santing (Ministry of Finance), Ti 2010-078/3.

Theses

The study of the impact of early life conditions on later life events: A look across the individual’s life course

In-utero and childhood environmental, biological and economic factors are by now established determinants of not only long-term health conditions (such as cardiovascular disease and diabetes), but also individual longevity. The literature is inconclusive, however, on the significance of conditions during adulthood when later life outcomes are largely predetermined in the early years of one’s life. One possibility is that intermediary life events mitigate or aggravate the impact of early-life conditions on later life outcomes.

This thesis considers how the sequence and timing of events — including birth, childhood, marriage, fertility and mortality — influence the individual’s life course. It studies the interplay between early-life conditions and endogenous later life events, like marriage and fertility, in influencing adult health and life outcomes. Such a life-course approach allows for the identification of causal effects linking these important life events, resulting in vital policy implications.

The first essay in this dissertation considers marriage, and focuses on understanding the extent to which this event is endogenous (that is, also determined by early life conditions). This endogeneity is taken into account to examine the residual causal impact of marriage on mortality. The simultaneous analysis of marriage and mortality shows that conditions around birth, as well as around the school ages, are important for both marital status and mortality. The results are strikingly different across gender. Men on average enjoy a protective effect of marriage on longevity — and this effect increases with age. For women, early life events mediate the impact of marriage on mortality. Women born in economic booms gain life expectancy from marriage during their childbearing years, but women born in recessions suffer a substantial negative effect on life expectancy during these same years.

The second essay follows directly from the first, and investigates further the result of the adverse effect of marriage on women’s health during childbearing ages. Proceeding under the supposition that marriage could be acting as a proxy for fertility (which is physically taxing for women), the essay considers the impact of economic conditions at birth and in years up to puberty and child birth on the individual fertility rate. Results show that women born during favourable economic times exhibit, on average, lower fertility rates. This analysis also shows that fertility has a large, protective causal effect on female mortality in a woman’s post-reproductive years. The size of this effect varies by age and the number of children born to the woman.

The vital role of early life conditions in influencing later life outcomes directly or via mediating intervening life events, as shown in the first two essays, calls for public policy targeted at deprived children who are bound to be affected by early life adversity throughout their lives. The third (and final) essay of this dissertation evaluates such a major public affirmative-action programme for a deprived caste in India. The study
evaluates whether a particular redistribution policy that reserves a substantial fraction of public sector jobs and positions in institutions of higher learning for a deprived caste in India (which was attempted in the programme implemented on 8 September 1993) has affected infant and child mortality rates among the targeted caste. Results point towards a favourable impact of the policy. Child mortality rates decreased for the target group of the programme in rural areas – the areas where child mortality has been highest.

**Thesis: 'The study of the impact of early life conditions on later life events: A look across the individual's life course' by Sumedha Gupta. Published in the Tinbergen Institute Research Series #477**

### Managing consumer resistance to innovations

Over the last decades, a large number of new products have been introduced, thereby improving (or at least changing) people’s lives. However, many innovations meet consumer resistance when introduced in the market. This dissertation examines how consumers react to new products or services, and focuses on how consumer resistance towards innovations can be managed. Three different research questions on this phenomenon are investigated in separate empirical studies. The first study looks at consumer response to radical innovations. Consumers experience difficulties comprehending and evaluating radical innovations, due to their newness in terms of technology and benefits offered. Consequently, these innovations are not easily adopted in the market. This study examines how bundling such radical innovations with existing products may enhance consumer acceptance of radical innovations. The results of an experimental study among representative consumers in The Netherlands provide evidence of this effect, contingent upon the level of fit perceived to exist between the radical innovation and the product that accompanies it in the bundle. In a second study, a conceptual model is developed and tested that describes the impact of forced use of technology-based self-services. Technology-based self-services, like touch screens or ticket machines, allow customers to perform (parts of) the service by themselves. However, although this is an increasing practice, little is known about the effects of “forcing” consumers to use technology-based self-service options. This study shows that forced use leads to negative attitudes toward using the technology-based self-service, as well as toward the provider of these services. An additional finding is that offering interaction with an employee as a “fall-back” option offsets the negative consequences of forced use.

A final study in the thesis investigates the effect of consumer expertise on the evaluation of a new technology-based self-service. The idea is that although expertise is generally found to be advantageous in the adoption of technology-based self-services, it could also depress positive experiences of these services. In support of the hypothesis it is found that technological expertise indeed negatively affects the evaluation of the self-service. Moreover, by disentangling technological expertise and service expertise, this study showed that evaluations by technology experts were more negative for service experts than for service novices, and that evaluations by technology novices were more positive for service experts than for service novices. These research findings show that firms should carefully consider the roles of technology and service expertise when “forcing” their customers to use a new self-service option.

**Thesis: 'Managing consumer resistance to innovations' by Machiel Reinders. Published in the Tinbergen Institute Research Series #475**

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